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DEPARTMENT OF AGRICULTURE

Sixteenth Annual Report of the Coffee Research and Experimental Station, Lyamungu, Moshi 1949

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CONTENTS

	Page
General	1
Improvement of Planting Material	1
Improvement of Growing Conditions	3
Effect of Age on Liquoring Standard	5
Effect of Environmental Conditions on Bean Characters	5
Liquoring	5
Vegetative Propagation	5
Distribution of Seed and Planting Material	6
Pests and Diseases	6
Mbosi Sub-Station	6
Lyamungu Coffee Estate	7
Animal Husbandry	7
Visitors	8
Details and Analyses of Experiments	
IMPROVEMENT OF PLANT MATERIAL :	
Experiment XVIII	8
Experiment IV	23
Experiment II	27
Experiment II—Single Tree Selections	35
Experiment I—Single Tree Selections	35
Kents Plot Selections	34
Experiment III	36
Experiment IIIa	36
IMPROVEMENT OF GROWING CONDITIONS :	
Experiment V	37
Experiment XV	39
Experiment XIVa	42
Experiment IX	44
Experiment XIII	46
Experiment XIX	48
Experiment XVII	48
Extract From Chemist's Annual Report, 1937	49
Horticulturist's Report	51
Table Showing Grades and Classifications of Coffee Produced in the Seasons 1945 to 1949	66
Rainfall Records, 1937-1949	67

Coffea arabica only has been used in the experiments referred to in this Report.

All yields are calculated on the basis of hundredweights of clean coffee per acre.

References in the footnotes are to the pages on which full details, including results to date, of the particular experiment may be found.

A difference between any two treatments greater than the figure given as "significant difference" is due to the particular treatment. The proof is not absolute, but unless otherwise stated the figure for significant difference is at the level of probability $P=0{\cdot}05$, which means that the chances against drawing a wrong conclusion by using the significant difference figure is nineteen to one. If the significant difference is based on $P=0{\cdot}01$ then the chances are ninety-nine to one against the conclusion being wrong.

Where no figure for significant difference is given the differences that occur cannot be considered as being due to the particular treatment.

COFFEE RESEARCH AND EXPERIMENTAL STATION, LYAMUNGU, MOSHI

Report for the period 1st January to 31st December, 1949

The present report departs from previous issues in that there has been a rearrangement in the presentation of the information, with the first section devoted to a general review of the results of experiments and of the progress made, and the second section giving the full details of treatments and results of the various trials.

GENERAL

One additional experiment (XIX[1]) was planted during 1949. This occupies 5·5 acres and is designed to compare the effects of interplanted bananas and the application of farmyard manure on coffee grown on the multiple stem system.

The clonal selection trials in Experiment XVIII were extended by the addition of two squares. These are to be grown on the multiple stem system.

The average yield of clean coffee per acre for the season 1949 was 12·38 cwt., the average for 1949 and the two previous seasons is 9·45 cwt. A statement showing the grades and classifications obtained for the 1949 season and the three previous seasons is shown on page 66.

The rainfall for the calendar year was the lowest on record. Taking into account the rainfall of November-December, 1948, that for the months January-July, 1949, must be considered to have been well distributed and effective, but for the rest of the year the rainfall was very light.

Picking commenced abnormally early (30th June) and continued to mid-January. Despite the length of time over which ripening took place, only about one and a half per cent of the crop was taken off as "buni".

IMPROVEMENT OF PLANTING MATERIAL

The recording of the progeny, both clonal (Experiments XVIII[2] and IV[3]), and seedling (Experiment II[4]), of the selections was continued. In addition, the yields of possible selections in the Kents plot[5], Experiment I[6], and Experiment X and single trees within the Seedling Selection Trial (Experiment II[6]) were recorded; similarly recordings of grafted trees in the Museum Plot were also carried out.

With regard to the clonal progeny of the seventy-four selections planted in various squares of Experiment XVIII, it is too early to draw any conclusions as to the relative merits of the various selections under the particular conditions. Some have yielded at a much higher rate than others in the early cropping years, but this difference may not be maintained over a longer period of years. Except S. 16, all of the selections in the squares

1 See page 48.
2 See page 8.
3 See page 23.
4 See page 27.
5 See page 34.
6 See page 35.

planted in 1943 have averaged 8 cwt. of clean coffee per acre for the 1949 and the two previous seasons, H. 66 (L.S. VIII) and KP. 532 (L.S. X) have reached 12 cwt. per acre as an average for these three seasons.

In these squares, planted in 1943, biennial bearing has been marked over the last three seasons, although KP. 228 (L.S. VII), H. 66 (L.S. VIII), KP. 532 (L.S. X) showed this tendency to a less extent than the others, all of these yielding over 5 cwt. of clean coffee per acre in the "off" season (1948). Despite the fact that they were the highest yielders in their particular squares in the 1947 season, in the 1949 season each of these yielded at the rate of 14 cwt. of clean coffee per acre. This suggests that these particular trees may be more suited to the conditions.

The yields of seedlings from thirty-six selected mother trees (Experiment II[1]) have been recorded for eight years and the results so far show that there are marked differences in cropping capacity under the conditions of the experiment. The actual yields in some squares, R.B. II for example), are relatively low. but this is probably due to poor soil conditions. Seedlings of the following mother trees have given higher yields than others in the same section of the experiment:—F. 502, P. 313, P. 280, F. 839, L. 1, N. 39, N. 69, F. 840, H. 1, H. 61 and J. 49.

The trees selected within the progeny plots of any one mother tree have, with one exception, yielded at a higher rate than the average for the particular progeny plots for the four years 1946 to 1949[2]. For example, Tree No. F. 502/1 yielded at the average rate of 13·68 cwt. per acre, whereas the average for all the seedling progeny plots of this mother tree (F. 502) was at the rate of 9·87 cwt. per acre. How far this apparent increased yielding capacity can be ascribed to the inherent characters of F. 502/1 cannot be assessed until its vegetative progeny can be recorded, since soil conditions where F. 502/1 was planted may have been more favourable. Similar considerations apply to the other individual tree selections.

Additional trials of clonal material of various selections were laid down in 1949 at Usa River and Arusha. This brings the total numbers of such trials to thirteen.

The important question of whether or not the vegetative progeny (clone) of a parent is superior in any respect (yield, bean characters) to that of the seedling progeny has not been finally decided. There are two experiments (III and IIIA[3]) in which the comparison is possible and in each several parents are represented. In one experiment (Experiment IIIA) the yields have been recorded for the first five years of bearing and the clones have yielded significantly higher (5·7 cwt. against 5·1 cwt.) than seedlings. In Experiment III, where the yields were recorded in the tenth or eleventh year from planting, the reverse is the case, the seedlings significantly outyielding the clones (14·7 cwt. against 11·779 cwt.).

Measurements were made of the beans produced, in 1949, by clones and seedlings from these two experiments.

Although there are differences in the various measurements when individual bean measurements of those from clones and seedlings in either one of the two experiments are studied, the differences do not show the same tendency in each experiment, e.g. in Experiment IIIA seedlings produce

[1] See page 27.
[2] See page 35.
[3] See page 36.

significantly longer, thicker and heavier beans than those from clones, while in Experiment III the beans from clones and seedlings show no difference in any of these measurements, though the beans from seedlings are significantly wider.

Analysing together the figures from Experiment III and IIIA for length, width, and thickness no significant differences occur between beans from clones and those from seedlings.

In neither Experiment III nor IIIA are there any significant differences between beans from clones and seedlings in respect of weight, volume and specific gravity when a series of twenty-five bean samples are studied. It is therefore possible to conclude that, for the 1949/50 season, beans from clones and seedlings from Experiment III and IIIA showed no real differences.

As a result of submitting samples for three seasons in the case of Experiment IIIA, no differences in the liquoring qualities of beans from clones and seedlings were determined. Samples from Experiment III were submitted from the crop of the 1948/49 and 1949/50 seasons, the samples from clones and seedlings were placed in the same class in each year, but in the 1949/50 season the Liquorer expressed a preference for the liquoring qualities of beans from clones.

One would be justified in considering that there is no difference between the liquoring capacities of beans from clones and seedlings, when grown under any one set of conditions, e.g. within one experiment. There are indications that no difference in liquoring capacity occurs even over a wider area, e.g. within the limits of the Station.

IMPROVEMENT OF GROWING CONDITIONS

In the experiments (V[1] and XV[2]) in which mulches (elephant grass and banana trash respectively) are treatments, significant increases in yield over a period of years have been obtained by their applications. No further increase accrues as a result of increasing the quantity applied over the 40lb. per tree level. In Experiment XIVA, where guinea grass is used as a similar treatment as well as elephant grass and banana trash, and all at a rate of 80lb. per tree, no significant increase in yield is obtained from any of these treatments, although there is an indication that all have a slight beneficial effect even at this level of application.

Irrigation at all levels (Experiment XV[2]) increases yields significantly, but the heavier applications do not effect any increase over that obtained by irrigation at the two inches per month level. The effect on yield of the application of irrigation together with mulch is, for the whole period of the experiment, additive, although in the 1949 season there was an interaction.

In Experiment V[1] compost and sulphate of ammonia (at the higher rate) are effective when applied singly, but in combination with each other or with mulch (elephant grass) no benefit occurs over and above that obtained by applying them singly. Neither compost nor sulphate of ammonia (at the higher rate) gives significantly better yields than the elephant grass applied at the rate of 40lb. per tree. Sulphate of ammonia, when applied in combination with compost or mulch, tends to depress yields. The application of

[1] See page 37.
[2] See page 39.

compost in Experiment XIVA[1] has not effected a significant increase in yield, and in the same experiment sulphate of ammonia has generally depressed yields, though not significantly so, both when applied alone and in combination with various mulches. The results obtained so far from the application of sulphate of ammonia when applied alone or in combination with mulches, lead to the view that increased yields are not dependent on a high level of soil nitrogen in April and May, except possibly where no mulch treatment is given. (*See* extract of the Annual Report for 1937 on page 49, in which the Chemist discusses nitrate production under various soil treatments.)

The experiment (VI) in which three different sources of nitrogen (sulphate of ammonia, nitrochalk and ammonium nitrate) at different rates and times of application was modified and the effect, if any, of these modifications in the time of application of the treatments will not be seen until the 1950/51 crop is harvested and the results analysed.

A study of the yields over the period 1947-1949 shows that mulches, when applied alone, do not counteract biennial bearing. Biennial bearing is not overcome, except in a few instances (Experiment V[2]—Plots 120, 121, 211 and 222), by the combination of mulch with either compost or nitrogen or both. The biennial bearing habit is also seen in the nil treatment plots. On the other hand, all the irrigation treatments in Experiment XV[3], except the thirty plots, and the irrigation plus mulch treatments, do not show this same tendency to biennial bearing despite the very much higher standard of cropping.

It can therefore be stated that under the conditions existing at this Station, soil moisture has been a limiting factor to a high level of annual cropping during these years. That this factor has been limiting for a period or periods only during a season is shown by the fact that in the "on" year (1948) the nil treatment and mulched plots set a heavy crop (c.f. Experiment XV, OO plot 1948). It appears that in the nil treatment and mulch plots, soil moisture at some time subsequent to flowering has not been such as to allow the required level of nutrition to be maintained during the "on" year to ripen the crop, and at the same time produce wood ready to flower in the following season.

In the Cultivation Experiment (IX[4]) the fork jembe and envelope fork treatments gave significantly higher yields than those of the other treatments in 1949. The yields of any one season, subject of course to cherry ripening normally, and there being no fall of immature cherry, are a reflection of the conditions during the months of the previous season in which flower buds were laid down. The rains of April-May 1948 were unusually light and root growth may have commenced prior to the application of the treatments, cultivation with a jembe would have severed these roots. The effect of the "no cultivation" treatment, which involves the slashing of weeds only, may, in the relatively dry months that followed the April-May rains of 1948, have been to compete with the coffee for soil moisture at a critical time. The severance of roots in the one plot, and the competition for moisture in the other, may have resulted in less vigorous growth, which was reflected in the extent of flowering in November-December, 1948. For the whole period of the experiment (twelve years) no significant differences in yield occur as a result of the treatments, although the fork jembe treatment has resulted in slightly better yields than the others.

[1] See page 42. [2] See page 37. [3] See page 39. [4] See page 44.

In 1949 the trees pruned on the single stem system outyielded those pruned on the normal multiple stem system (Experiment XIII[1]). Over the whole period of twelve years, the multiple stem system has given a much higher yield, a mean of 9·9 cwt. of clean coffee per acre against 6·9 cwt.

EFFECT OF AGE OF TREE ON THE LIQUORING STANDARD

In the 1930's the opinion was often voiced that the liquoring standard of coffee produced by trees in their early bearing years was higher than that produced by the same trees at a later stage. In order to investigate this point an experiment (XVII[2]), using a seedling material of both Bourbon and Kents, was laid down in 1937. Additional plots were planted in each succeeding year up to 1944. In 1949, samples of coffee from the plots of the various ages were taken and submitted for liquoring, unfortunately some of the samples were reported on as being tainted or slightly tainted, due probably to contamination during preparation. Making allowance in the case of the samples which were tainted or slightly tainted, in the 1949-50 season there seems to be no more than half a class difference between the coffee produced by trees which have been thirteen years in the field and that produced by trees which have been eight years in the field. (The classification for the various plots is given on page 48.)

EFFECT OF ENVIRONMENTAL CONDITIONS ON BEAN CHARACTERS

Gilbert* compared the bean characters for nine estates for two seasons in regard to seasonal influences and found that season had a pronounced effect.

A comparison of random samples of 500 beans from the 1949 crop from plots of the same clone (N. 39) growing under different conditions on the Station (L.S. I—Experiment XVIII and L.S. II—Experiment IV) showed significant differences in respect of length and thickness but not in width. The weight, volume and specific gravity of samples, each of twenty-five beans taken from the 500 bean sample, showed significant differences in weight and volume.

The differences are all in favour of the sample from the plots of N. 39 in Experiment XVIII and these yielded at a much higher rate than those from the plots of the same clone in Experiment IV (11·49 cwt. per acre against 5·63 cwt.). This indicates that, even within a clone, yield is not necessarily a factor detrimental to bean size.

LIQUORING

During the year over 5,000 plot and individual tree samples were taken for the purposes of out-turn and liquoring. An experiment designed to investigate the origin of "onion" taint in the liquor gave no positive results.

VEGETATIVE PROPAGATION

(See also Horticulturist's Report on pages 51 to 65)

An analysis of all cuttings taken during 1948 indicated the time required to root, and the general effects on rooting of the season during which cuttings

* Annual Report, 1937.

1 See page 46.

2 See page 48.

were taken and the season during which they rooted. A further analysis for 1949, according to age of the cuttings rooted, and those which died after rooting, confirmed that the longer the cuttings take to root the higher on the average will be the percentage number of deaths after rooting.

Experimental work showed that the internodal position of the basal cut gave a higher percentage number of cuttings rooted and also induced them to root quicker than the nodal position; and a split cut appeared to be the most satisfactory type of cut. As a result, all cuttings are now prepared by severing at the centre of an internode and splitting the stem up to the node immediately above the point of severance. Encouraging results were obtained from the use of wild date palm fibre as a rooting medium. The inferiority of coffee parchment was clearly demonstrated when directly compared with other media, while the efficiency of peat moss was again confirmed. In comparing different proportions of organic material and sand, a tendency was noticed for rooting to be quicker and at a higher rate when the amount of organic material was decreased and the proportion of sand was increased within a limited range.

DISTRIBUTION OF SEED AND PLANTING MATERIAL OF THE POTENTIAL SELECTIONS

One thousand, six hundred and seventy-four pounds of seed were sold to growers, and rooted cuttings were supplied to the Moshi Native Coffee Board for use as sources of material for vegetative propagation.

PESTS AND DISEASES

Pre-monsoon spraying with one per cent Bordeaux Mixture against *Hemileia vastratrix* was carried out. Bordeaux Mixture was again applied in July, in this case D.D.T. was incorporated in it in order to deal with *Antestia lineacotiles* in the same operations, this was successful.

In the first quarter of the year the control of Antestia was achieved by using a 0·1 per cent emulsion of D.D.T. at the rate of twenty-four gallons per acre.

There was no occurrence of Thrips.

Incidence of White Stem borer (*Anthores leuconotus*) showed an increase over previous years. Formerly confined to the south-east corner of the Station, it has now been found in other plots further east and to the north of its original occurrence.

The mealy bug, *Pseudococcus filamentosus*, appeared in Experiment XVIII in April and caused considerable distortion of the growing points of the young growth. By September it had practically disappeared.

MBOSI SUB-STATION

Fire swept through the four squares of the Selection Trial (Experiment I) during October, 1949, and resulted in the deaths of many of the plants. Sufficient planting material was obtained from the nursery to supply two squares only.

A spacing trial was planted with a view to getting information as to the optimum spacing for coffee in the Mbosi district. An experiment to investigate methods of establishing young coffee was also planted. The treatments

include the placement of phosphate in the bottom of the planting hole and in the vicinity of the roots when planting and the combination of these treatments with the application of compost. (It should be noted that analysis of the soils of the Mbosi area indicate a low phosphate status.)

In common with the remainder of the district, symptoms of what is considered to be Boron deficiency occur. The symptoms correspond very closely to those described for Boron deficiency in coffee, grown in sand culture, by a worker in Java. Coffee so affected shows a blackening and withering of the growing points of the primaries and often the main stems, followed by "dieback". These symptoms are most marked at the beginning of the growing season. Application of Borax to the soil around the affected tree has been undertaken in an endeavour to correct the condition.

LYAMUNGU COFFEE ESTATE

The seven acres cleared in 1948 were planted with maize, the stand showed the area to be of reasonably even fertility.

A further sixteen acres were cleared; on this area the shade trees (Erythrina, Grevillea and Albizzia) were at a density of forty per acre. These were uprooted with a monkey winch. The whole of this area was infested with "couch" (*Digitaria scalarum*); to remove this a Wilmot deep digging plough was used behind a Fordson tractor, cross ploughing with the Fordson was impossible. At the end of the year an Allis Chalmers H.D.5 was purchased and the area cross ploughed and scuffled. Ploughing to a depth of sixteen inches to eighteen inches threw up most of the couch, which was removed by scuffling and the land made ready to plant maize with the rains of 1950.

Work on renovating the thirty-one acres of mature coffee on the estate was continued. Ten acres were pruned preparatory to conversion to multiple stem. The twenty acres of single stem coffee remaining flowered heavily at the end of the year. This provides a useful demonstration of methods employed in regenerating neglected, but vigorous, coffee.

ANIMAL HUSBANDRY

The cattle, which are all Zebu, are kept primarily for the production of "muck", but a programme of breeding for increased milk production is also followed.

There were four cases of "fly" during the year; of these, one beast died.

Twenty-nine cows were in milk during the year and yielded a total of 5,945 gallons of milk. One cow produced 388·9 gallons during the year, the highest yield in one day was 27·8 lb.

Twenty-eight calves were born and four of the best bull calves were sent to various Departmental Stations.

The silage made in 1948 was relished by the cattle, but attempts to feed coffee pulp, either fresh, dried or ensiled, failed.

Trial plots of the following grasses were established with a view to investigating their possibilities for fodder and mulch purposes:—*Chloris gayana* (two strains), *Paspalum notatum*, *P. dilatatum*, *Digitaria swazilandensis*, *Panicum makarikariensis*, *Eremochloa ophiuroides* and *Pennisetum clandestinum*.

VISITORS

Visitors to the Station included the Hon. the Director of Agriculture: Mr. C. G. Eastwood, of the Colonial Office; Mr. C. W. Hartly, Department of Agriculture, Federation of Malay States; Mr. F. B. Wilson, Department of Agriculture, Kenya; M. P. Staner, Ministry of Colonies, Brussels.

A Planters' Day, attended by forty members of the Tanganyika Coffee Growers' Association, was held on 19th July. Similar days were arranged for parties from the Kilimanjaro Native Co-operative Union, various Native Authority school children, and also a party of Africans from Bukoba.

I wish to record my thanks to Mr. C. R. Devonshire, Liquorer to the Kenya Coffee Marketing Board, for liquoring the many coffee samples sent to him, and also to Mr. P. Robinson, Statistician, East African Agriculture and Forestry Research Organization, for his advice on the analysis of various experiments.

I wish also to express my appreciation of the work done by the staff of this Station.

Coffee Research Station,
Lyamungu, Moshi,
December, 1950.

F. R. Sanders,
Senior Research Officer.

DETAILS AND ANALYSES OF EXPERIMENTS AND HORTICULTURIST'S REPORT

Experiment XVIII.—*Clonal Selection Trials*

These trials consist of a series of 6×6 latin squares, wherein the yields of rooted cuttings of potential selections are compared. Planting commenced in April, 1943; additional squares have been planted up subsequently, as material became available. By the end of 1949, sixteen squares had been planted, of which thirteen were in bearing. All squares planted prior to April 1944 (eight in number) have been pruned on the single stem system; those planted subsequently have been grown on multiple stem. Each square is planted with the following shade trees, each of the six plots of any one clone having a different semi-permanent shade tree.

Semi-permanent:—

Albizzia moluccana
Albizzia stipulata
Albizzia sp. ("Tangasale")
Cordia holstii
Ficus sycamorus
Maesopsis eminii

Permanent:—

Albizzia maranguensis

Yearly yields and mean yields for each square are given in the following tables, the calculated yields of the original parents being included for reference. Except where otherwise indicated, the yields, expressed as cwts. of clean coffee per acre, have been calculated on a sixteen per cent out-turn basis.

Latin Square I.—Planted 29th April, 1943—Single Stem

Parent		Clone	1945	1946	1947	*1948	1949	Mean of 5 years 1945—49	
Mean Yield	No. of years recorded							Cwt.	Percentage
16·83	7	N 39	4·84	1·30	*13·61	2·46	11·49	6·74	96·3
10·17	7	R 23	1·29	1·44	12·32	0·52	16·94	6·50	92·9
13·59	7	N 71	1·37	2·18	12·09	1·12	16·36	6·63	94·7
32·48	1	I 60	2·04	3·52	14·98	1·10	16·45	7·62	108·9
6·69	4	M 2	1·90	3·37	12·07	1·97	15·02	6·86	98·1
11·44	8	L 1	2·33	2·04	14·45	1·23	18·12	7·63	109·1
Mean			2·29	2·31	13·25	1·40	15·73	7·00	100·0
Standard error			0·26	0·45	—	0·32	0·82	0·30	4·2
Significant difference (P = ·05)			0·76	1·32		0·94	2·42	0·87	12·5

*Using actual out-turn.

LATIN SQUARE II.—PLANTED 30TH APRIL, 1943—SINGLE STEM

PARENT		Clone	1945	1946	1947	*1948	1949	Mean of 5 years 1945-49	
Mean Yield	No. of years recorded							Cwt.	Percentage
17·12	7	N 20	1·44	2·22	10·54	1·25	13·25	5·74	89·1
12·54	7	N 30	2·98	0·95	10·54	0·86	12·61	5·59	86·8
14·39	7	N 29	3·03	2·43	12·31	1·59	13·71	6·61	102·7
14·55	7	N 5	5·29	0·93	*12·92	1·06	10·92	6·22	96·7
32·04	1	N 48	2·06	2·43	10·81	0·73	15·20	6·25	97·0
13·88	7	N 197	4·17	5·33	*14·07	1·60	15·92	8·22	127·6
Mean			3·17	2·39	11·87	1·18	13·60	6·44	100·0
Standard error			0·33	0·46	—	0·18	0·81	0·32	5·0
Significant difference (P = ·05)			1·39	1·35	—	0·53	2·38	0·96	14·8

*Using actual out-turn.

Latin Square III.—Planted 26th October, 1944—Multiple Stem

Parent		Clone	1947	*1948	1949	Mean of 3 years 1947—49	
Mean Yield	No. of years recorded					Cwt.	Percentage
14·55	7	N 5	*6·26	11·42	14·39	10·69	108·4
13·77	6	AB 35	4·56	11·60	11·63	9·26	93·9
11·49	12	KP 154	3·25	13·40	15·33	10·66	108·1
14·78	12	KP 423	6·82	13·48	14·11	11·47	116·3
5·04	4	M 97	5·51	10·51	10·99	9·01	91·4
12·13	7	N 106	5·79	8·10	10·24	8·04	81·5
Mean			5·37	11·42	12·78	9·86	100·0
Standard error			—	0·62	0·93	0·40	4·1
Significant difference (P = ·05)			—	1·84	2·73	1·18	12·0

*Using actual out-turn.

Latin Square VII.—Planted 7th June, 1943—Single Stem

Parent		Clone	1945	1946	1947	*1948	1949	Mean of 5 years 1945–49	
Mean Yield	No. of years recorded							Cwt.	Percentage
13·87	7	R 15	3·63	2·50	*13·13	0·94	17·81	7·60	108·6
11·23	7	N 81	3·76	3·65	15·43	2·92	16·39	8·43	120·4
9·60	12	KP 228	2·80	2·80	14·62	5·79	14·37	8·08	115·4
10·45	7	I 49	2·14	1·43	10·78	1·24	14·75	6·06	86·6
3·75	3	S 16	2·32	0·95	10·43	1·18	11·33	5·24	74·9
15·19	7	N 34	1·68	1·90	10·57	1·28	17·57	6·60	94·3
Mean			2·73	2·21	12·49	2·23	15·37	7·00	100·0
Standard error			0·44	0·38	—	0·42	0·78	0·34	4·9
Significant difference (P = ·05)			1·30	1·12	—	1·25	2·30	1·02	14·6

*Using actual out-turn.

Latin Square VIII.—Planted 13th August, 1943—Single Stem

Parent		Clone	1945	1946	1947	*1948	1949	Mean of 5 years 1945—49	
Mean Yield	No. of years recorded							Cwt.	Percentage
14·02	7	R 2	2·38	4·55	13·75	1·28	19·36	8·26	102·7
11·27	4	H 66	2·58	3·47	*20·28	7·72	14·55	9·72	120·8
6·14	4	M 7	1·46	3·48	11·24	1·96	17·22	7·07	87·9
11·95	6	AB92	0·95	3·20	11·43	2·36	16·16	6·82	84·7
15·04	7	N 218	2·23	2·25	14·62	3·26	16·17	7·80	97·0
13·58	7	N 100	2·22	4·65	*14·30	1·77	20·09	8·60	106·9
Mean			1·97	3·59	14·27	3·06	17·34	8·05	100·0
Standard error			0·35	0·47	—	0·68	1·20	0·40	5·0
Significant difference (P = ·05)			1·02	1·38	—	2·00	2·54	1·19	14·8

*Using actual out-turn.

Latin Square IX.—Planted 20th December, 1943—Single Stem

Parent		Clone	1946	1947	*1948	1949	Mean of 4 years 1946—49	
Mean Yield	No. of years recorded						Cwt.	Percentage
10·49	6	AC 98	4·07	9·54	4·24	14·07	7·98	87·8
18·38	7	R 3	5·22	10·12	1·70	18·43	8·87	97·6
10·62	12	KP 683	4·46	13·63	4·78	14·54	9·35	102·9
14·07	7	N 205	6·60	13·02	3·10	18·30	10·25	112·8
10·94	7	N 128	4·87	12·91	1·75	17·37	9·22	101·4
11·29	7	I 5	4·58	10·39	2·87	17·52	8·84	97·2
Mean			4·96	11·60	3·07	16·71	9·09	100.0
Standard error			—	—	0·51	1·36	0·50	5·5
Significant difference (P = ·05)			—	—	1·49	—	—	—

*Using actual out-turn.

Latin Square X.—Planted 29th December, 1943—Single stem

Parent		Clone	1946	1947	*1948	*1949	Mean of 4 years 1946—49	
Mean Yield	No. of years recorded						Cwt.	Percentage
36·90	1	N 110	4·79	12·99	3·02	11·45	8·06	88·1
7·37	3	M 95	4·13	11·16	0·93	13·22	7·36	80·4
11·28	12	KP 532	5·36	16·03	8·32	14·84	11·14	121·7
13·88	7	N 197	9·50	*13·70	3·13	17·31	10·92	119·3
11·98	7	I 235	5·15	12·05	2·38	15·73	8·83	96·5
11·71	7	R 11	5·18	11·14	1·62	16·45	8·60	94·0
Mean			5·69	12·85	3·24	14·83	9·15	100·0
Standard error			—	—	0·64	0·85	0·29	3·7
Significant difference (P = ·05)			—	—	1·90	2·50	0·86	9·4

*Using actual out-turn.

Latin Square XI.—Planted 16th April, 1946—Multiple Stem

Parent		Clone	*1948	*1949	Mean of 2 years 1948—49	
Mean Yield	No. of years recorded				Cwt.	Percentage
9·22	11	KI 363	3·01	16·34	9·67	124·1
13·88	7	N 197	1·18	10·91	6·05	77·7
13·58	7	N 100	1·80	12·88	7·34	94·2
18·38	7	R 3	1·20	10·68	5·94	76·3
14·55	7	N 5	1·67	18·14	9·90	127·1
16·83	7	N 39	1·08	14·56	7·82	100·4
Mean			1·66	13·91	7·79	100·0
Standard error			0·21	0·91	0·49	6·3
Significant difference (P = ·05)			0·61	2·69	1·43	18·4

*Using actual out-turn.

Latin Square XII.—Planted 16th April, 1946—Multiple Stem

Parent		Clone	*1948	*1949	Mean of 2 years 1948–49	
Mean Yield	No. of years recorded				Cwt.	Percentage
10·81	12	KP 227	3·16	17·89	10·53	116·4
11·81	7	N 181	3·50	17·94	10·72	118·5
13·58	7	N 100	3·29	13·93	8·61	95·1
10·03	7	R 24	1·76	11·99	6·88	76·0
13·11	12	KP 231	0·89	12·41	6·66	73·6
12·55	12	KP 163	3·32	18·53	10·93	120·8
Mean			2·65	15·45	9·05	100·0
Standard error			0·55	1·15	0·98	10·8
Significant difference (P = ·05)			1·62	3·39	2·89	31·9

*Using actual out-turn.

Latin Square XIII.—Planted 26th April, 1946—Multiple Stem

Parent		Clone	*1948	*1949	Mean of 2 years 1948-49	
Mean Yield	No. of years recorded				Cwt.	Percentage
11·27	5	X 321	2·71	13·69	8·20	132·9
10·76	6	AC 189	3·49	7·71	5·60	90·8
13·58	7	N 100	0·79	8·60	4·69	76·0
Mean			2·33	10·00	6·17	100·0
Standard error			0·72	0·84	0·63	10·2
Significant difference (P = ·05)			—	3·05	2·28	37·0

*Using actual out-turn.

Latin Square XIV.—Planted 21st May, 1947—Multiple Stem

Parent Mean Yield	No. of years recorded	Clone		1949 Cwt.	1949 Percentage
18·38	7	R	3	0·38	77·6
15·20	7	N	50	0·57	116·3
15·87	4	H	1	0·49	100·0
10·59	6	AC	53	0·42	85·7
36·90	1	N	110	0·58	118·4
Unknown	–	KIL	10	0·46	93·9
Mean				0·49	100·0
Standard error				0·13	26·5
Significant difference (P = ·05)				–	–

Latin Square XV.—Planted 26th January, 1944—Single Stem

Parent		Clone	1946	1947	*1948	*1949	Mean of 4 years 1946—49	
Mean Yield	No. of years recorded						Cwt.	Percentage
11·95	6	AB 11	1·63	12·63	2·61	11·99	7·21	105·4
15·20	7	N 50	0·82	9·82	1·72	13·88	6·56	95·9
11·44	8	L 1	1·17	13·66	2·74	13·52	7·77	113·6
9·32	12	KP 263	1·54	9·62	6·38	8·29	6·46	94.4
11·83	7	I 47	1·23	10·73	2·23	12·31	6·63	96·9
14·08	7	N 215	1·95	9·97	1·79	11·91	6·40	93·6
Mean			1·39	11·07	2·91	11·99	6·84	100·0
Standard error			—	—	0·61	1·00	0·41	6·0
Significant difference (P = ·05)			—	—	1·79	2·94	—	—

*Using actual out-turn.

Latin Square XVI.—Planted 3rd March, 1944—Single Stem

Parent							
Mean Yield	No. of years recorded	Clone	1946	1947	*1948	*1949	Mean of 4 years 1946—49	
							Cwt.	Percentage
11·27	7	N 198	0·72	7·93	2·67	13·30	6·16	99·5
18·38	7	R 3	0·66	7·88	0·87	13·23	5·66	91·5
8·38	7	R 25	0·66	7.04	2·01	11·49	5·30	85·7
12·63	7	N 76	0·83	8·83	3·89	13·77	6·83	110·3
13·31	7	N 220	0·86	4·85	2·87	10·52	4·78	77·2
13·88	7	N 197	1·33	*9·29	5·34	17·66	8·41	135·8
Mean			0·85	7·64	2·94	13·23	6·19	100·0
Standard error			—	—	0·60	0·70	0·27	4·4
Significant difference (P = ·05)			—	—	1·78	2·08	0·80	12·9

*Using actual out-turn.

Latin Square XVII.—Planted 13th September, 1945—Multiple Stem

Parent		Clone	*1948	*1949	Mean of 2 years 1948-49	
Mean Yield	No. of years recorded				Cwt.	Percentage
6·74	12	KP 162	6·76	17·91	12·33	137·2
15·19	7	N 34	7·20	15·79	11·49	127·8
14·71	7	N 14	1·90	8·89	5·39	60·0
12·66	7	I 56	4·84	11·81	8·33	92·7
18·38	7	R 3	4·99	11·86	8·42	93·7
7·13	7	F 502	6·05	9·94	7·99	88·9
Mean			5·29	12·70	8·99	100·0
Standard error			0·91	1·05	0·85	9·5
Significant difference (P = ·05)			2·67	3·10	2·50	27·8

*Using actual out-turn.

Experiment IV.—*Squares II, V and IX—Clonal Selection Trials*

The three original squares in experiment IV were uprooted because of the unsuitability of the various exotic coffees planted therein. As material became available, they were each replanted with the same five clones, squares II and V being grown on the single stem system and square IX on the multiple stem. The spacing is eight feet by eight feet apart.

The results have been disappointing, probably due to the heavy shade, prior to 1948, of *Acrocarpus fraxinifolius*, *Cordia holstii* and *Albizzia maranguensis*, and the previous existence of coffee in the area. However, the yields in 1949 showed some improvement.

Latin Square V.—Planted 9th April, 1942—Single Stem

Parent		Clone	1945	1946	1947	1948	1949	Mean of 5 years 1945—49	
Mean Yield	No. of years recorded							Cwt.	Percentage
16·83	7	N 39	2·47	CROP FAILED	3·28	5·76	4·82	3·19	69·8
18·38	7	R 3	4·37		8·52	0·88	10·30	4·57	100·0
11·44	8	L 1	3·86		9·58	1·51	11·12	4·95	108·3
13·58	7	N 100	2·97		9·74	0·93	11·66	4·78	104·5
13·88	7	N 197	4·23		10·09	2·65	11·27	5·37	117·5
Mean			3·58		8·24	2·35	9·83	4·57	100·0
Standard error			0·33		—	0·459	0·94	0·24	5·3
Significant difference (P = ·05)			1·02		—	1·415	2·91	0·74	16·2

Latin Square II.—Planted 13th April, 1943—Single Stem

Parent		Clone	1945	1946	1947	1948	1949	Mean of 5 years 1945—49	
Mean Yield	No. of years recorded							Cwt.	Percentage
16·83	7	N 39	1·11	CROP FAILED	4·84	2·34	5·63	2·65	72·4
18·38	7	R 3	1·31		6·56	0·38	9·70	3·40	122·7
11·44	8	L 1	1·40		8·21	1·51	12·52	4·49	101·6
13·58	7	N 100	1·19		7·64	1·01	9·90	3·72	110·7
13·88	7	N 197	1·64		8·08	1·48	10·23	4·05	92·9
Mean			1·33		7·07	1·34	9·60	3·66	100·0
Standard error			0·15		—	0·351	0·64	0·15	4·1
Significant difference (P = ·05)			0·45		—	1·083	1·98	0·46	12·8

Latin Square IX.—Planted 17th March, 1944—Multiple Stem

Parent		Clone	1948	1949	Mean of 2 years 1948–49	
Mean Yield	No. of years recorded				Cwt.	Percentage
16·83	7	N 39	2·19	11·30	6·75	118·6
18·38	7	R 3	2·34	7·18	4·76	83·7
11·44	8	L 1	1·94	7·09	4·52	79·4
13·58	7	N 100	2·61	9·30	5·95	104·6
13·88	7	N 197	2·86	10·08	6·46	113·5
Mean			2·39	8·99	5·69	100·0
Standard error			0·44	1·06	0·68	12·0
Significant difference			—	—	—	—

Experiment II.—*Seedling Selection Trials*

These trials are laid out in the form of four 6 × 6 Latin squares, and two randomized blocks, each with nine selections repeated six times. The object of the experiment is to compare the yields of seedling progeny of potential selections under the conditions existing at this station. The area has high light shade of *Albizzia maranguensis*, *Cordia holstii* and *Leucaena glauca*.

The yearly yields, and means over the bearing period, are given in the following tables and are expressed as cwts. of clean coffee per acre. The calculated yields of the parent trees, from which the original seed was obtained, are also given as a matter of interest, together with the number of years for which each tree was recorded. No direct comparison between these latter is possible, however, except where they bear the same initial letter, since they originate from estates often in widely differing districts.

Latin Square I.—Planted May, 1938—Single Stem

Summary of Results for 1941-1949

Parent		Selection	1941	1942	1943	1944	1945	1946	1947	1948	1949	Mean of 9 years 1941—49	
Mean Yield	No. of years recorded											Cwt.	Percentage
7·13	7	F 502	1·32	2·65	6·82	8·42	3·94	5·02	16·32	4·14	14·00	6·96	128·4
15·00	5	P 280	1·21	4·35	7·01	7·87	2·55	4·85	13·84	1·80	12·15	6·18	117·7
11·88	5	P 313	0·95	4·60	6·17	8·30	2·57	4·45	13·78	4·37	12·21	6·38	114·0
12·32	5	P 348	0·84	2·07	4·43	6·38	1·19	5·31	9·75	4·63	9·42	4·89	85·6
13·17	5	P 147	0·73	1·57	3·82	5·96	1·54	4·20	10·09	4·88	8·99	4·64	90·2
13·34	5	P 190	0·77	1·29	1·53	3·69	0·87	3·63	6·56	6·78	6·22	3·48	64·2
Mean			0·97	2·76	4·96	6·77	2·10	4·58	11·72	4·43	10·50	5·42	100·0
Standard error			—	0·29	0·33	0·42	0·38	0·51	0·73	0·70	1·06	0·26	4·8
Significant difference			—	1·55 (P=·001)	0·96 (P=·05)	1·24 (P=·05)	1·12 (P=·05)	—	2·17 (P=·05)	2·06 (P=·05)	3·11 (P=·05)	0·78 (P=·05)	14·4

Latin Square II.—Planted October, 1938—Single Stem

Summary of Results for 1942-1949

Parent		Selection	1942	1943	1944	1945	1946	1947	1948	1949	Mean of 8 years 1942—49	
Mean Yield	No. of years recorded										Cwt.	Percentage
15·04	4	H 133	1·56	4·67	4·57	1·45	3·18	13·37	1·98	12·11	5·34	102·5
11·44	8	L 1	1·13	4·86	4·42	2·05	3·52	14·42	4·45	12·92	5·97	114·6
9·39	7	F 839	1·11	4·78	5·39	3·91	2·38	15·38	3·70	13·03	6·21	119·2
16·83	7	N 39	0·93	3·09	3·35	3·46	3·04	12·86	6·48	7·99	5·15	98·8
13·17	5	P 147	0·76	2·78	4·28	0·88	3·29	10·17	5·02	9·21	4·54	87·1
7·50	7	E 59	0·69	2·04	3·94	0·88	3·20	8·62	5·74	7·04	4·02	77·2
Mean			1·03	3·71	4·29	2·10	3·10	12·47	4·56	10·38	5·21	100·0
Standard error			0·27	0·37	0·24	0·33	0·44	0·69	0·73	0·65	0·19	3·6
Significant difference (P = ·05)			—	1·08	0·70	0·99	—	2·02	2·22	1·91	0·56	10·7

Latin Square III.—Planted October, 1938—Single Stem

Summary of Results for 1942-1949

Parent		Selection	1942	1943	1944	1945	1946	1947	1948	1949	Mean of 8 years 1942-49	
Mean Yield	No. of years recorded										Cwt.	Percentage
15·07	4	H 1	1·34	4·85	8·36	3·64	1·82	15·78	7·55	14·67	7·25	122·9
8·76	7	F 840	0·90	4·57	7·87	3·65	3·44	15·96	4·33	14·80	6·94	117·6
11·88	5	P 313	3·13	4·30	5·87	0·75	2·29	11·24	1·26	14·83	5·46	92·5
13·75	7	N 69	1·83	5·42	5·06	1·53	3·37	11·89	1·62	17·45	6·02	102·0
15·20	7	N 50	1·54	4·77	4·55	1·08	2·61	10·81	1·45	15·55	5·30	89·8
6·57	7	E 665	1·40	2·44	4·24	0·55	2·78	8·51	3·64	12·08	4·46	75·6
Mean			1·69	4·39	5·99	1·87	2·72	12·37	3·31	14·90	5·90	100·0
Standard error			0·26	0·33	0·44	0·37	0·45	1·07	0·45	1·05	0·32	5·4
Significant difference			1·39 (P=·001)	0·96 (P=·05)	1·30 (P=·05)	1·08 (P=·05)	—	3·14 (P=·05)	1·34 (P=·05)	3·09 (P=·05)	0·95 (P=·05)	16·1

Latin Square IV.—Planted 1939—Single Stem

Summary of Results for 1942-1949

Parent													
Mean Yield	No. of years recorded	Selection	1942	1943	1944	1945	1946	1947	1948	1949	Mean of 8 years 1942—49	
											Cwt.	Percentage
11·23	7	N 81	0·94	1·56	2·78	0·01	1·28	6·60	1·29	9·08	2·94	77·8
16·83	7	N 39	0·05	0·61	1·81	0·09	0·62	6·52	2·79	9·65	2·77	73·3
11·44	8	L 1	0·75	1·65	3·53	0·12	1·59	10·27	1·52	11·28	3·84	101·6
15·07	4	H 1	0·81	3·78	6·23	2·16	0·88	13·41	6·71	10·39	5·48	145·0
13·88	7	N 197	0·55	2·19	3·37	0·12	2·61	10·51	2·70	13·30	4·42	116·9
18·38	7	R 3	0·98	2·16	2·39	0·04	1·34	7·35	1·11	10·51	3·23	85·4
Mean			0·68	1·91	3·35	0·42	1·39	9·11	2·69	10·70	3·78	100·0
Standard error			0·08	0·17	0·25	—	0·26	0·71	0·62	0·91	0·22	5·8
Significant difference			0·44 (P=·001)	0·50 (P=·05)	0·74 (P=·05)	—	0·77 (P=·05)	2·10 (P=·05)	1·81 (P=·05)	2·69 (P=·05)	0·66 (P=·05)	17·5

Randomized Block 1.—Planted April, 1939—Single Stem

Summary of Results for 1942-1949 crop

Parent		Selection	1942	1943	1944	1945	1946	1947	1948	1949	Mean of 8 years 1942—1949	
Mean Yield	No. of years recorded										Cwt.	Percentage
11·71	7	R 11	0·83	CROP FAILED	CROP FAILED	1·95	1·17	**9·65**	2·07	16·20	4·15	89·2
14·02	7	R 2	0·65			1·68	1·32	**9·51**	3·09	16·80	4·29	92·3
14·49	4	H 61	0·72			5·94	1·21	**13·93**	8·99	16·62	6·14	132·0
Unrecorded		R.R.H.—vigorous	0·87			4·10	1·74	**14·27**	5·90	15·31	5·50	118·3
24·22	7	R 13	0·82			1·86	1·34	**11·71**	4·33	15·71	4·70	101·1
15·04	4	H 133	0·91			1·87	1·32	**11·49**	3·76	17·30	4·82	103·7
10·81	6	J 104	0·80			1·51	1·44	10·38	4·00	16·66	4·57	98·3
12·13	7	N 106	0·55			1·36	1·24	9·42	3·38	15·54	4·10	88·2
14·55	7	N 5	0·46			1·47	0·70	7·81	5·49	11·68	3·55	76·3
Mean			0·74			2·42	1·27	10·90	4·56	15·76	4·65	100·0
Standard error			0·12			0·41	0·21	0·71	0·78	0·98	0·18	3·9
Significant difference			0·21 (P=·2)			1·18 (P=·05)		2·03 (P=·05)	2·24 (P=·05)	2·80 (P=·05)	0·51 (P=·05)	11·0

Randomized Block II.—Planted April, 1939– Single Stem

Summary of Results for 1942-1949 crop

Parent													
Mean Yield	No. of years recorded	Selection	1942	1943	1944	1945	1946	1947	1948	1949	Mean of 8 years 1942 –1949	
											Cwt.	Percentage
13·58	7	N 100	1·27	CROP FAILED	CROP FAILED	0·55	CROP FAILED	10·11	1·50	13·46	3·81	105·5
13·59	7	N 217	1·58			0·59		9·38	1·74	13·76	3·74	103·6
13·93	7	R 1	1·13			0·48		9·15	2·11	12·99	3·69	102·2
12·63	7	N 229	0·89			0·35		7·79	1·51	14·37	3·53	97·8
15·19	7	N 34	1·24			0·45		9·33	1·54	12·22	3·42	94·7
7·69	7	E 325	0·52			0·63		6·87	4·27	11·00	3·26	90·3
12·76	7	N 182	0·83			0·62		6·88	4·49	11·65	3·35	92·8
14·08	7	N 215	1·03			0·49		8·06	2·44	11·90	3·37	93·4
12·41	6	J 49	1·37			0·64		10·26	1·63	16·20	4·26	118·0
Mean			1·10			0·53		8·64	2·36	13·06	3·61	100·0
Standard error			0·17			—		0·77	0·54	0·86	0·17	4·7
Significant difference (P = ·05)			0·53			—		2·22	1·53	2·47	0·47	13·0

Kents Plot Selections—Single Stem

Tree No.	Mean of 12 years 1938—1949	Tree No.	Mean of 12 years 1938—1949
KP. 146	13·07	KP. 266	8·49
,, 147	8·27	,, 281	7·67
,, 151	7·72	,, 285	11·29
,, 154	11·49	,, 289	10·41
,, 162	6·74	,, 352	9·61
,, 163	12·55	,, 362	11·19
,, 164	12·02	,, 405	11·33
,, 176	6·98	,, 406	11·65
,, 204	11·58	,, 409	11·14
,, 214	6·69	,, 412	9·62
,, 215	14·08	,, 414	9·19
,, 218	10·15	,, 423	14·78
,, 226	7·16	,, 466	10·51
,, 227	10·81	,, 512	10·96
,, 228	9·60	,, 518	7·43
,, 231	13·11	,, 532	11·28
,, 260	12·18	,, 683	10·62
,, 261	7·96	,, 685	11·02
,, 262	10·93	VC. 276	9·09
,, 263	9·32	,, 363	8·45
,, 265	12·82	,, 364	9·16

Records of Individual Trees within the Seedling Progeny Plots of Various Mother Trees in Experiment II

Tree No.	1946	1947	1948	1949	Mean of 4 years 1946—49
F. 502/1	11·54	19·01	3·61	20·55	13·68
F. 502/2	13·66	14·93	0·07	14·73	10·85
F. 502/3	15·70	8·06	15·69	13·86	13·33
F. 839/1	9·76	16·80	1·07	23·02	12·66
F. 839/2	7·47	18·16	7·71	9·67	10·75
F. 839/3	13·15	16·38	5·44	27·39	15·59
F. 839/4	2·21	10·27	2·45	20·48	8·85
F. 839/5	13·41	9·84	3·21	16·48	10·74
F. 839/6	1·61	13·66	5·12	14·81	8·80
F. 840/1	2·80	11·96	4·51	20·23	9·88
F. 840/2	4·07	10·27	7·79	23·45	11·40
F. 840/3	6·87	34·54	0·77	19·85	15·51
F. 840/4	7·64	27·32	2·35	26·14	15·86
F. 840/5	12·81	13·32	2·58	23·76	13·12
F. 840/6	3·22	20·11	6·72	15·31	11·34
H. 1/1	6·62	25·03	7·00	27·67	16·58
H. 1/2	10·52	18·92	3·42	28·05	15·23
H. 1/3	1·78	29·70	4·09	20·52	14·02
P. 280/1	12·56	16·89	6·17	11·72	11·84
P. 280/2	9·93	9·76	13·32	5·58	9·65
P. 280/3	5·26	7·13	0·80	18·45	7·91
P. 280/4	6·11	10·35	2·80	18·04	9·33
P. 280/5	6·96	15·78	1·67	13·53	9·49
P. 280/6	6·96	16·29	0·58	17·13	10·24
P. 313/1	11·29	11·46	10·99	11·03	11·19
P. 313/2	5·52	20·96	4·16	20·07	12·68
P. 313/3	8·40	20·28	5·73	13·95	12·09
P. 313/4	3·65	15·44	0·39	19·68	9·79
P. 313/5	4·33	13·24	1·59	17·04	9·05
P. 313/6	11·23	15·86	1·18	17·11	11·35

Experiment I—Selections

Tree No.	Mean of 12 years 1938—1949	Tree No.	Mean of 12 years 1938—1949
11	14·49	197	15·86
33	17·81	200	15·66
55	16·24	255	15·97
71	16·55	339	16·42
179	12·38	448	17·07
188	15·97		

Experiment III.—*Clones v. Seedlings—Planted 1938*

This experiment was originally designed to compare clones (rooted cuttings) with seedlings of the same parent, both by themselves and as root-stocks grafted with scions from another single mother-tree. The trees are pruned on the single stem system and the area is lightly shaded with *Albizzia maranguensis*. Although planted in 1938 (as a 4 × 4 latin square) difficulties regarding the technique of grafting in the field were experienced. The advent of the war, and consequent shortage of staff, aggravated the position, and even now there are a number of missing trees. In an endeavour to obtain further evidence regarding the respective merits of rooted cuttings and seedlings of the same parents (cf. Experiment IIIA below), it was decided to commence recording the yields of this experiment in 1948. Ten mother-trees are represented. Due allowance has been made in the analysis for the missing trees. The yields for the years 1948 and 1949 are given below.

	1948	1949	Mean of 2 years
Clones	8·83	15·75	11·78
Seedlings	12·16	16·12	14·74
Mean	10·50	15·94	13·26
Standard error	1·80	1·87	0·29
Significant difference ...	—	—	1·63

Seedlings have given a significantly higher yield than clones in this experiment.

Experiment IIIA.—*Clones v. Seedlings—Planted 1942*

This is designed to give a straight comparison between clones (rooted cuttings) and seedling progeny of the same mother-trees; the experiment is laid out as randomized blocks repeated ten times; the trees are pruned on the single stem system. Shade is afforded by *Albizzia stipulata* and *Maesopsis eminii*, with *Albizzia maranguensis* as the permanent shade tree. As in Experiment III there are a number of missing trees for which allowance has been made in the analysis. This correction is for differences in numbers only. The records of the experiment having been kept by plots and not by individual trees makes it impossible to correct the analysis for the differences in yield of the progeny of the various mother-trees represented in the experiment. Individual tree records are now being kept. Nine mother-trees are represented. The yields for the period 1945-49 are shown below.

	1945	1946	1947	1948	1949	Mean of 5 years 1942—49
						Cwt.
Clones	3·17	CROP FAILED	5·45	8·48	10·91	5·71
Seedlings	2·06		4·66	9·44	9·43	5·13
Mean	2·62		5·06	8·96	10·17	5·42
Standard error	0·23		0·17	0·46	0·53	0·11
Significant difference ... (P = ·05)	0·75		0·55	—	—	0·50

For the five-year period clones have given a significantly higher yield than seedlings.

EXPERIMENT V.—*Mulch, Compost and Nitrogen—Planted 1940*

This is a partially confounded $3 \times 3 \times 3$ factorial experiment designed to determine the effects on yield of mulch, compost and Sulphate of Ammonia at three quantity levels separately and in all combinations. The material used for mulching is dried elephant grass. The area is unshaded; the trees, which are unselected clonal material, are pruned on the single stem system.

Treatments (per tree):

Mulch: M0 = Nil.
M1 = 40 lb. dried Elephant Grass.
M2 = 80 lb. dried Elephant Grass.

Compost: C0 = Nil.
C1 = 1 debe (petrol tin) compost.
C2 = 2 debes (petrol tin) compost.

		1940—42	1943—45	1946—49
Nitrogen:	N0 =	Nil	Nil	Nil
	N1 =	1 oz. Sulphate of Ammonia.	2 oz. Sulphate of Ammonia.	3 oz. Sulphate of Ammonia.
	N2 =	2 oz. Sulphate of Ammonia.	4 oz. Sulphate of Ammonia.	6 oz. Sulphate of Ammonia.

The mulch is applied after the long rains, the compost is applied just before the long rains and is lightly forked in ; the Sulphate of Ammonia is applied after approximately fifteen inches of rain have fallen.

The annual yields and also the summary for the years 1942-49 are given in the following table. The liquoring classification is shown for the years 1947, 1948 and 1949.

Mulch	Compost	Nitrogen	1942	1943	1944	1945	1946	1947	Liquoring Classification	1948	Liquoring Classification	1949	Liquoring Classification
0	0	0	1·26	0·29	0·45	11·23	CROP FAILED	7·39	2	22·75	ALL 2—	7·14	3
0	0	1	1·28	0·55	0·58	11·49		9·27	2	25·17		8·57	2
0	0	2	1·00	0·36	0·92	13·65		11·54	2	21·57		13·39	2
0	1	0	1·46	0·54	0·95	17·18		12·98	2	22·39		11·32	2
0	1	1	1·42	0·51	1·17	14·21		15·14	2	17·79		15·15	2
0	1	2	1·35	0·46	0·65	10·39		11·48	2	19·06		15·34	3
0	2	0	1·71	0·68	1·03	17·61		10·58	2	24·69		11·62	2
0	2	1	1·32	0·37	1·16	14·16		12·95	2	20·09		13·71	2
0	2	2	0·42	0·36	0·64	13·29		11·92	2	17·09		16·02	2
1	0	0	1·85	0·49	0·88	15·27		8·89	2	24·76		9·61	2
1	0	1	1·51	0·59	1·43	14·32		11·30	2	21·01		11·90	2
1	0	2	1·48	0·39	1·20	12·83		10·42	2	17·30		12·67	2
1	1	0	2·31	0·60	0·97	15·84		12·95	2	20·41		16·09	2
1	1	1	2·18	0·78	0·82	13·15		10·00	2	20·83		12·13	2
1	1	2	1·42	0·46	1·43	16·17		13·13	2	22·44		14·81	2
1	2	0	1·99	0·64	1·49	13·53		15·86	2	17·45		14·65	3
1	2	1	1·52	0·47	0·70	13.01		15·14	2	16·49		15·15	2
1	2	2	1·65	0·57	1·04	12·18		10·63	2	22·38		11·91	2
2	0	0	1·86	0·53	1·01	14·09		14·51	2	20·91		14·42	2
2	0	1	1·65	0·56	1·28	13·52		12·22	2	20·17		14·11	2
2	0	2	1·38	0·31	0·87	9·47		9·70	2	19·14		14·18	2
2	1	0	1·24	0·51	1·15	13·34		10·48	2	20·81		14·16	2
2	1	1	1·64	0·31	0·76	14·41		14·09	2	17·81		13·14	2
2	1	2	1·56	0·17	0·92	15·30		12·80	2—	17·41		14·63	2
2	2	0	1·38	0·54	1·24	14·06		11·96	2—	18·82		13·61	2
2	2	1	1·66	0·61	1·07	10.01		10·81	2	22·81		10·92	2
2	2	2	1·67	0·53	1·04	12·96		13·30	2—	16·93		14·30	3

MEAN YIELD OF 8 YEARS, 1942-49

	N0			N1			N2		
	C0	C1	C2	C0	C1	C2	C0	C1	C2
M0 ...	6·314	8·352	8·484	7·113	8·173	7·968	7·803	7·292	7·520
M1 ...	7·718	8·645	8·200	7·759	7·487	7·810	7·085	8·733	7·492
M2 ...	8·415	7·711	7·699	7·938	7·772	7·243	6·831	7·900	7·592

Standard Error ± 0·385
Significant Difference ± 1·087

From the table above the effects of the simple treatments are :—

M0	6·314	C0	6·314	N0	6·314
M1	7·718	C1	8·352	N1	7·113
M2	8·415	C2	8·484	N2	7·803

Compared with the nil treatment plots the following plots have yielded at a significantly higher rate :—

M_1 and M_2
C_1 and C_2
N_2

However between these (M1, M2, C1 and N2) there is no significant difference in yield.

No benefit has been derived from a combination of treatments, in fact the application of Sulphate of Ammonia in combination with either, or both, of the other treatments has tended to depress yields.

EXPERIMENT XV.—*Irrigation and Mulch—Planted 1940*

This is a complex partly confounded factorial experiment laid out as an 8 × 8 quasi-latin square. It is designed to investigate the effects of irrigation and mulch, both separately and in combination, on coffee culture. The material used for mulching is dried banana trash. The experiment is planted with four different clones, from unselected mother-trees, and the behaviour of these clones is also recorded. They are pruned on the single stem system. The area is unshaded.

Treatments :—

Irrigation :
0 = Nil.
1 = made up to 2 inches effective rainfall monthly.
2 = made up to 4 inches effective rainfall monthly.
3 = made up to 2 inches effective rainfall fortnightly.

Mulch :
0 = Nil.
1 = Banana trash 40 lb. per tree at end of long rains.
2 = Banana trash 80 lb. per tree at end of long rains.
3 = Banana trash 40 lb. per tree at end of both long and short rains.

Clone:
1 = KIL 50
2 = KIL 98
3 = KIL 48
4 = KIL 10

The annual yields for the various treatments are given in the following table together with the summary for the years 1942-49. The figures in the columns following the annual yields for the years 1947, 1948 and 1949 indicate the liquoring classification.

Yield and Classification

Irrigation	Mulch	1942	1943	1944	1945	1946	1947	Liquoring Classification	1948	Liquoring Classification	1949	Liquoring Classification
0	0	0·38	2·22	—0·05	2·61	—0·30	2·19	1	15·47	2	4·26	3
0	1	1·42	5·76	1·72	1·97	1·21	8·31	2	20·81	2	8·88	4
0	2	1·61	6·11	1·88	1·21	0·44	8·28	3	21·14	2	7·93	4
0	3	1·35	5·53	2·67	1·10	0·70	7·48	2	17·29	3	9·48	4
1	0	0·66	4·95	2·55	1·54	3·42	12·43	1	12·33	2	15·00	2
1	1	1·80	8·29	2·99	0·86	4·33	17·76	2	16·63	2	18·79	4
1	2	2·03	9·32	2·87	1·80	1·95	14·65	2+	16·97	2	14·22	4
1	3	1·76	7·97	3·24	1·34	4·20	16·69	1—	15·75	2	15·20	4
2	0	0·86	6·46	2·94	1·56	3·75	12·54	1	11·06	2	18·05	2—
2	1	1·72	9·57	3·26	1·04	3·68	15·10	2	14·29	2	18·10	4
2	2	2·43	7·94	2·33	0·97	3·00	15·10	2	16·25	2	16·17	4
2	3	1·70	6·87	3·46	1·17	3·14	15·21	2	17·32	2	13·76	4
3	0	1·10	5·11	2·85	1·07	1·92	12·55	2	8·39	2	16·04	2
3	1	1·96	7·44	2·76	0·20	3·85	17·97	2—	14·25	2	15·05	2—
3	2	2·22	7·02	4·27	0·54	3·42	18·08	2	15·37	2	16·12	2—
3	3	1·59	5·75	4·08	0·70	2·96	17·40	2—	15·39	3	12·87	2

Mean Yield of 8 years, 1942-1949

MULCH	IRRIGATION 0		1		2		3		Mean (Mulch)	
	Cwt. per acre	%	Cwt. per acre	%	Cwt. per acre	%	Cwt. per acre	%	Cwt. per acre	%
0	3·347	46·7	6·611	92·3	7·212	100·7	6·129	85·6	5·825	81·3
1	6·258	87·4	8·930	124·7	8·345	116·5	7·933	110·8	7·867	109·8
2	6·074	84·8	7·975	111·3	8·022	112·0	8·381	117·0	7·613	106·3
3	5·697	79·5	8·269	115·5	7·827	109·3	7·592	106·0	7·346	102·6
Mean (Irrigation)	5·344	74·6	7·946	110·9	7·851	109·6	7·509	104·8	7·162	100·0

	Cwt.		%
Standard Error for Marginal Means	0·190	...	2·7
Significant Difference for Marginal Means	0·561	...	7·8
Standard Error of Entries in body of table	0·379	...	5·3

The mulch and irrigation treatments have all been effective. No advantage has accrued from the heavier applications of mulch or irrigation, in fact these heavier applications have, for the whole period of the experiment, tended to depress yields when these are compared with the yields of the plots receiving the lighter treatments.

Experiment XIVA.—*Mulch—Planted 1940*

Laid out as a 5×5 latin square, with split plots to show the effects of sulphate of ammonia, this experiment is designed to determine the effects on yield of banana trash, guinea grass (*Panicum maximum*) and elephant grass (*Pennisetum purpureum*) applied as mulches, compost made from an equivalent amount of elephant grass, and clean cultivation. The trees are clonal material from unselected mother trees and are pruned on the single stem system. The area is sparsely shaded with *Albizzia maranguensis* as the permanent shade tree.

Treatments:

A—Control—routine clean cultivation.
B—Banana trash (80 lb. per tree).
C—Elephant Grass (80 lb. per tree).
D—Guinea Grass (80 lb. per tree).
E—Compost (80 lb. per tree).

Sulphate of Ammonia (Sub-plots):

1941-2—2 oz. per tree.
1943-4—4 oz. per tree.
1946-8—8 oz. per tree.

As in Experiment V, the mulches (dried material) are applied after the long rains; the compost is applied just before the long rains and is lightly forked in; the Sulphate of Ammonia is applied after approximately fifteen inches of rain has fallen.

The yearly results and the mean for the 8-year period 1942-1949 are given in the following table.

N1=Plots to which Sulphate of Ammonia applied.
N0=Plots to which no Sulphate of Ammonia applied.

	1942		1943		*1944		*1945		*1946		*1947		*1948		*1949		Summary of 8 years 1942-49			
	Sub-plots		Sub-plots		Sub-plots		Sub-plots		Sub-plots		Sub-plots		Sub-plots		Sub-plots		Sub-plots			
	N1	N0	N1	N0	N1	N0	N1	N0	N1	N0	N1	N0	N1	N0	N1	N0	N1	Per-centages	N0	Per-centages
Treatments																				
A. Nil	1·80	1·66	4·68	5·04	0·04	0·07	11·82	9·43	0·06	0·23	11·50	14·35	5·92	6·38	12·99	16·58	6·18	88·7	6·68	95·8
B. Banana Mulch ... ... (80 lb. per tree).	1·87	2·31	4·09	4·82	0·36	0·84	11·90	10·77	0·36	0·90	13·30	15·97	8·33	8·02	15·93	17·83	7·00	100·4	7·63	109·5
C. Elephant Grass ... ... (80 lb. per tree).	1·73	1·80	4·55	4·67	0·23	0·50	11·50	12·40	0·13	0·19	14·76	13·64	5·78	7·49	14·65	21·39	6·63	95·1	7·72	110·8
D. Guinea Grass ... ... (80 lb. per tree).	1·90	2·21	4·18	5·87	0·35	1·53	11·25	8·40	0·35	0·83	16·89	15·14	6·70	7·73	16·84	16·34	7·27	104·3	7·18	103·0
E. Compost ... ... (1 debe per tree).	1·22	1·29	4·23	5·63	0·06	0·10	10·75	10·52	0·03	0·44	17·03	13·18	4·73	6·75	16·60	15·40	6·80	97·6	6·59	94·5
Mean	1·70	1·85	4·34	5·21	0·25	0·61	11·44	10·30	0·19	0·44	14·70	14·46	6·49	7·27	15·40	17·51	6·78	97·3	7·16	102·7
Standard error	0·009	0·009	0·13	0·13	0·329	0·329	0·409	0·409	0·070	0·070	1·229	1·229	0·740	0·740	1·32	1·32	0·31	1·9	0·34	4·9
Significant difference (P ·05).	–	–	0·36	0·36	–	–	1·208	1·208	0·207	0·207	3·627	3·627	–		3·88	3·88				

*Results worked out on actual out-turn basis. Remainder on 16%

Over the whole period of the experiment no significant differences in yield have resulted from the application of mulches or compost. Except when applied with Guinea Grass or compost, the application of Sulphate of Ammonia has tended to depress yields.

Experiment IX.—*Cultivation—Planted 1934*

Laid out as a 5×5 latin square, the object of this experiment is to determine the effect of the various methods of cultivation. The experiment was planted with the seedling progeny of a planter's selection from a district remote from the Kilimanjaro—Meru coffee growing areas. It was originally grown on the single stem system without shade, but in 1944 it was converted to multiple stem. It is sited on sloping land, which had been previously terraced, with a western aspect.

Treatments:

A—Forked jembe (forked hoe).
B—Jembe (West Indian hoe).
C—No cultivation.
D—Envelope forking.
E—Trenching.

The annual yields together with the mean for twelve years, 1938-49, are shown in the following table.

Treatment:	*1938	*1939	*1940	*1941	*1942	*1943	*1944	*1945	*1946	†1947	†1948	†1949	Mean of 12 years 1938—1949	
													Cwt.	Percentage
A. Forked hoe (forked jembe)	5·77	0·27	2·60	9·23	1·86	7·86	CONVERTED TO MULTIPLE STEM	6·28	CROP FAILED	24·17	1·52	17·09	6·32	110·9
B. West Indian hoe (jembe)	5·79	0·48	2·74	8·23	2·43	7·73		6·60		22·14	0·68	14·99	5·91	103·8
C. No cultivation	5·61	0·41	2·20	9·16	1·90	7·17		5·79		17·79	1·14	13·45	5·32	93·5
D Envelope forking...	4·55	0·35	1·67	7·32	1·63	5·26		5·29		21·47	1·28	17·86	5·60	98·2
E. Trenching	4·81	0·45	2·11	9·33	1·38	5·80		5·24		19·49	0·12	16·10	5·31	93·2
Mean	5·31	0·39	2·26	8·66	1·84	6·76		5·84		21·01	0·95	15·90	5·70	100·0
Standard error	–	–	0·34	0·33	0·10	0·12		0·62		1·689	0·268	0·716	0·338	5·9
Significant difference (P = ·05).	–	–	1·05	–	–	–		–		–	0·825	2·21	–	–

*16% out-turn. †Actual out-turn.

Over the period of 12 years there is no significant difference between the yields of the plots under the various treatments.

EXPERIMENT XIII.—*Method of Pruning—Planted December, 1935*

This experiment is laid out as 3×3 latin squares repeated three times in different parts of the station. It is designed to compare three systems of pruning arabica coffee. Two of the replicates are lightly shaded with *Albizzia maranguensis*; the third is unshaded. The experiment is planted with seedling material.

Treatments:

S = Single stem.
M/3 = Multiple stem—3 suckers.
M/A = Multiple stem—Agobiada—3 suckers.

The yearly results, together with the summary, for the period 1938-49 are shown in the following table.

	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	Mean of 12 years 1938—1949	
Treatment:													Cwt.	Per-centage
Single stem	FLY CROP	1·982	2·996	7·290	3·991	5·318	5·319	9·589	1·04	20·492	9·318	15·052	6·894	85·0
Multiple stem, 3 suckers		2·348	11·928	12·962	12·034	17·238	5·677	7·079	2·30	29·578	5·056	12·701	9·927	122·4
Agobiada, multiple stem, 3 suckers		0·407	6·607	6·370	7·494	13·079	4·992	8·028	0·90	17·329	10·987	13·840	7·503	92·5
Mean		1·579	7·177	8·874	7·840	11·878	5·329	8·232	1·41	22·467	8·454	13·864	8·107	100·0
Standard error		0·301	0·493	0·700	0·401	0·843	0·127	1·013	0·312	0·410	0·764	0·552	0·248	3·1
Significant difference (P = ·05).		1·043	1·707	2·422	1·389	2·918	0·440	–	1·256	1·419	2·642	–	0·859	10·6

The multiple stem system shows a highly significant increase in yield.

Experiment XIX.—*Planted April, 1949*

This experiment is designed to compare the effects of interplanted bananas and the application of farmyard manure on coffee grown on the multiple stem system. The layout consists of randomized blocks repeated eight times.

The indigenous shade, consisting of *Albizzia maranguensis* and *Rawolfia inebriens*, has been reduced to one tree per plot.

Treatments:

Plots :

A—No bananas—best plantation practice.
B—As (A) plus 1 debe farmyard manure or compost per tree and per stem.
C—As (A) plus 2 debes manure.
D—Bananas interplanted 6 per plot—No manure.
E—As (D) plus 1 debe manure.
F—As (D) plus 2 debes manure.
G—Bananas 9 per plot—No manure.
H—As (G) plus 1 debe manure.
J—As (G) plus 2 debes manure.

Note.—Bananas kept to 1 bearer, 1 follower and 1 peeper.
Shade :—bottom of canopy not under 16 feet.
Manure applied and lightly forked in just before long rains.

Experiment XVII.—*Planted 1937*

The object of this experiment is to establish coffee of different ages with a view to subsequent study of the effects of this factor on yield and bean qualities.

The layout consists of randomized blocks repeated eight times. Each plot of sixteen trees is divided into two sub-plots, one being planted with coffee of Bourbon type and the other Kents type. Half the trees in a sub-plot are pruned on the single stem system and half on the multiple stem system.

The first planting took place in 1937, and the requisite number of plots were planted in each subsequent year up to and including 1944.

The liquoring classification of the coffee produced by the various plots in 1949 is given below :—

Planting			*Classification*
1937 ...			
	K. SS.	...	3
	K. MS.	...	3+
	B. SS.	...	3 Slight taint.
	B. MS.	...	3 Slight taint.
1938 ...			
	K. SS.	...	3
	K. MS.	...	4
	B. SS.	...	3 Taint.
	B. MS.	...	3 Slight taint.
1939 ...			
	K. SS.	...	3 Slight taint.
	K. MS.	...	4+ Taint.
	B. SS.	...	4 Slight taint.
	B. MS.	...	4+
1940 ...			
	K. SS.	...	4 Taint.
	K. MS.	...	4
	B. SS.	...	3 Slight taint.
	B. MS.	...	3 Slight taint.

Planting			*Classification*
1941 ...			
	K.	SS. ...	3
	K.	MS. ...	2
	B.	SS. ...	3 Taint.
	B.	MS. ...	2
1942 ...			
	K.	SS. ...	3
	K.	MS. ...	3
	B.	SS. ...	3 Taint.
	B.	MS. ...	3 Slight taint.
1943 ...			
	K.	SS. ...	4
	K.	MS. ...	3
	B.	SS. ...	3 Taint.
	B.	MS. ...	3 Taint.
1944 ...			
	K.	SS. ...	4+ Slight taint.
	K.	MS. ...	4+ Taint.
	B.	SS. ...	3 Taint.
	B.	MS. ...	2+

KEY

K. = Kents.
B. = Bourbon.
SS. = Single stem.
MS. = Multiple stem.

EXTRACT FROM CHEMIST'S 1937 ANNUAL REPORT

Studies in Nitrification and the Effect of Vegetable Mulches

Periodical observations have been continued on the production of nitrate as described in the annual report of 1936. It was particularly desirable to obtain information as to the nitrate status of the soil in the months following the long rainy season, namely, from June to December.

As in the 1936 rainy season, the nitrate content of the top soil was soon reduced to a low level, owing to the leaching action of continued heavy rain. Examination of leachings from different soils, placed in metre cube tubs, were made throughout this period : the amount of nitrate leached beyond a depth of one metre varied between twenty-three and sixty pounds of nitrogen per acre in ten weeks.

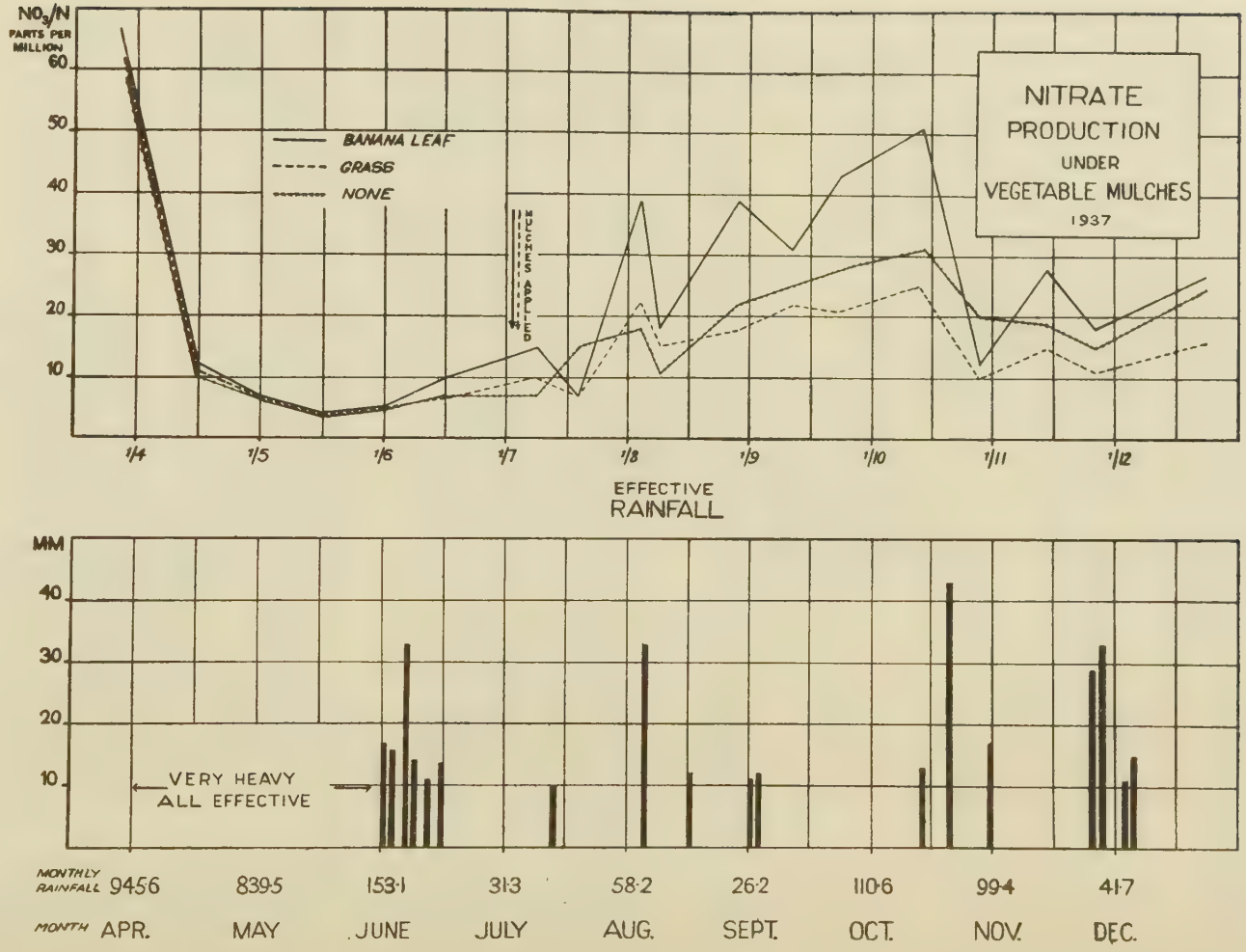
The replenishment of nitrate in the months succeeding the long rains was slow. (*Note*.—Almost all plants respond to applications of nitrogenous fertilizers at this time of the year.) The accompanying diagram* depicts graphically the effect of two kinds of vegetable mulch on the nitrification process. The mulches used were : (a) guinea grass containing 1·7 per cent nitrogen and a C :N ratio of 27 :1 and (b) dry banana leaf containing 1·2 per cent nitrogen and a C :N ratio of 40 :1.

Attention is called to the following main points :—

(1) The plots treated with banana trash in 1936 produced more nitrate in June 1937 (before renovation of the mulch) than those of other treatments : an important point in view of the generally low nitrate content at this time of year.

*See Graph IV on page 50.

Graph IV


NO3/N
PARTS PER MILLION
60
50
40
30
20
10
BANANA LEAF
GRASS
NONE
MULCHES APPLIED
NITRATE PRODUCTION UNDER VEGETABLE MULCHES 1937
1/4
1/5
1/6
1/7
1/8
1/9
1/10
1/11
1/12
EFFECTIVE RAINFALL
MM
40
30
20
10
VERY HEAVY ALL EFFECTIVE
MONTHLY RAINFALL 94·56 83·95 153·1 31·3 58·2 26·2 110·6 99·4 41·7
MONTH APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.

(2) The nitrate status is considerably higher under the banana mulch throughout the dry weather : during a period of occasional rains which were not heavy enough to cause leaching but sufficiently so to penetrate twelve to eighteen inches.

(3) After moderate rains which transport nitrate from the surface into the immediate sub-soil and root zone the resumption of nitrification in the surface soil is more pronounced under banana leaf mulch.

This is well illustrated by conditions tabulated below :—

Nitrate Nitrogen in Parts per Million of Soil.

Treatment	A 4/8/37	B 6/8/37	C 27/8/37
Banana leaf mulch ...	37·0	18·0	37·0
Grass mulch	23·5	14·0	18·0
Bare Soil	18·0	12·5	21·0

The fall in nitrate content from A to B is a result of 33mm. of rainfall. C represents conditions three weeks later, after a period of warm weather with occasional light showers.

(4) The grass mulch depresses nitrate production throughout the period under review.

This difference in behaviour between the two types of mulch is due to the fact that the grass breaks down too easily : presumably it contains sufficient nitrogen to start microbiological decomposition but insufficient to do so thoroughly without robbing the soil, to some extent, of nitrate. Banana trash, on the other hand with a higher C :N ratio markedly resists decomposition and acts more as an effective soil cover, conserving soil moisture and maintaining more even temperatures.

VEGETATIVE PROPAGATION

I—GENERAL

The urgent need for more drying space in the vicinity of the factory necessitated the removal of one of the mother-tree nurseries. The opportunity was taken of revising the whole layout and composition of the central mother-tree nursery. Clones not up to standard were discarded, while others were limited to ten trees of each clone, except for a few of the most promising ones, where twenty were retained. Space was thus found for the trees which had to be moved. Some of these trees were over seven years old, and yet all were successfully transplanted.

It was inevitable, as a result of this reorganisation, that the amount of suitable cutting material should be greatly reduced. In fact, from July until the end of the year only 104 cuttings were taken. The total taken during the year amounted to 13,287 ; by the end of December, 9,070 of these, or 68·3 per cent, had rooted. This compares with 60·3 per cent of the 1948 plantings rooted over a much longer period.

The stage has now been reached when the setting of cuttings must be undertaken during the periods of the year most favourable for this operation, due consideration being given to the optimum seasons for rooting and hardening-off and the time taken for the young rooted cuttings to be ready

for planting out in the field. Cuttings taken after November are unlikely to be large enough to plant out during the following rains and will be too big the year after. This appears to fit in with the preliminary survey of seasonal effect on all cuttings taken in 1948, and discussed below.

Analysis of All Cuttings Taken in 1948

A complete analysis of all cuttings taken and set in the frames during 1948 was undertaken. The monthly rooting of these cuttings was traced up to and including January 1950, when all unrooted cuttings from 1948 were finally discarded. It was thus possible to estimate the general effect on rooting of the following influences :—

(a) Time required to root.

(b) Season during which cuttings were taken.

(c) Season during which cuttings rooted.

During 1948, large numbers of cuttings were planted under conditions which have since been shown to be far from ideal, e.g. coffee parchment as a rooting medium, nodal cut at the base, etc. In addition, the cuttings taken in any one month were from a wide and varying range of clones, each with a different rooting capacity, and were themselves very variable in number. It was considered, however, that an analysis of this nature would give some indication of the results to be obtained by mass production of cuttings under the conditions prevailing at the time. Similar analyses for successive years will be necessary to confirm any seasonal effects on rooting, and it is hoped that progress will also be shown by the raising of the percentage number rooted and the speeding up of the rooting process. Space in the frames cannot be spared for the laying down of controlled experiments to illustrate these factors. No definite conclusions can therefore be drawn until probably three consecutive years have been similarly analysed, both separately and collectively. Accordingly, detailed figures and graphs have not been presented here, though the general inferences are considered to be worthy of mention, and are discussed below.

(a) The highest percentage rooting was shown by those cuttings which had been in the frames for six months. The rate of rooting rose steeply after two months, reaching its peak at six months, and thereafter falling off rapidly until after ten months, when the rate was very low. The rate of rooting up to thirteen months was recorded. Optimum rooting was obtained between two and one-half and eight and one-half months, after which period all unrooted cuttings would probably be best discarded; ten months is certainly the maximum time for retention of unrooted cuttings, based on this one year's figures.

(b) The influence of the season in which cuttings were taken appeared to follow the calendar quarters fairly closely; this is in accordance with climatic conditions, though improvement in rooting conditions as the year advanced may have masked these results to a certain extent. Rooting was highest and quickest when the cuttings were taken during the cool season, i.e. July to September.

(c) Cuttings also tended to root better during and just after the cool season, regardless of the time of year at which they were taken. The peak was reached during September and October.

As stated earlier, further figures are necessary before any recommendations can be made. From this one year's results it is difficult to separate out the various influences, but it would appear that the time taken to root is the most powerful.

Rooted Cuttings and Deaths after Rooting

Further analyses of the percentage losses during the hardening-off period after rooting were carried out on the lines indicated in the 1948 Annual Report. The number of cuttings rooted during the year, together with deaths after rooting, is shown in Table 1.

Table 1

1949	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Total rooted	1,330	932	697	1,081	1,125	661	782	1,117	2,066	2,408	1,309	585	14,093
Total died after rooting ...	269	148	165	254	195	104	136	147	327	445	267	167	2,624
Percentage died after rooting	20·2	15·9	23·7	23·5	17·3	15·7	17·4	13·2	15·8	18·5	20·4	28·5	18·6

It will be seen that the heaviest rooting again occurred in the months of September and October. The sharp increase in the percentage number of deaths after rooting towards the end of the year can be explained by the fact that these cuttings had, on the average, taken longer to root, thus giving added confirmation to last year's results.

An analysis according to age, similar to that of last year, of the cuttings rooted and those which died after rooting, was carried out for the whole twelve-month period January to December, 1949. A positive correlation between the time (in months) taken for the cuttings to root and the percentage number of deaths after rooting was again found to be highly significant ($r = \cdot 91$, $P = \cdot 01$). In this instance, any cuttings taking more than twelve months to root were discounted, as a consequence of the results obtained in 1948.

Confirmation is therefore obtained that the time taken for the cuttings to root does profoundly affect the percentage number of deaths after rooting. In 1949, a deviation from the mean time to root of one month was equivalent to an average deviation of 2·57 per cent from the mean percentage number of deaths after rooting.

The deaths after rooting occur both in the frames where the freshly-potted plants are placed to recover from the check of transplanting, and also outside during the hardening-off process prior to planting out in nursery beds. The percentage losses are higher in the frames than outside. For the six-month period July to December 1949, the percentage losses were apportioned as follows :—

Frames	10·1%
Outside	7·9%
Total	18·0%

It was suspected that another important factor concerning the losses after rooting was the question of light and shade. The frames which have been in general use for the newly-potted plants have been of the lean-to type against the sides of the potting-sheds. The roof of the sheds obtrude some little way over the frames, thus making the whole frame, but especially the back, rather dark and certainly much darker than the frames used for rooting. To combat this, the lower half of the roof (corrugated iron) of one of the sheds was removed and replaced by glass lights.

Records were kept throughout the year of the numbers dying in the frames against the shed with a half-glass roof, and those dying in the other frames against sheds with a complete corrugated iron roof. Percentage losses were as follows :—

In frames against shed with half glass roof	10·02%
In frames against shed with completed corrugated iron roof	14·70%

It appears therefore that shade is a contributory factor to the high percentage number of losses after rooting and will require careful regulating.

II—EXPERIMENTAL

Following up the work initiated in 1948, comprehensive experiments were laid down in the frames in an endeavour to elucidate the following problems :—

(a) Method and position of basal cut.

(b) Materials, grades and mixtures for use as rooting media.

In each experiment, the time taken for the cuttings to root in each treatment has been calculated as well as the percentage number of cuttings rooted. In addition, an attempt has been made to differentiate between the rooting capacity of the various clones used in the respective experiments.

(a) Basal Cut

Experiment 2/49.—As a result of experience gained from the preliminary trials reported in the 1948 Annual Report, an experiment was laid down, having the following treatments :—

A—Nodal split—Straight cut just below node and stem split for about one inch through node.

B—Nodal wedge—Wedge cut through node.

C—Nodal straight—Straight cut just below node—Control.

D—Internodal wedge—Wedge cut starting below node.

The experiment was laid out as four randomized blocks, each block being contained in one frame and having four plots of fifty cuttings each. Each block was represented by a different clone.

The results, after twenty-four weeks, are summarized in the following table :—

Table 2

	A	B	C	D	Mean	Standard error	Significant difference
Percentage rooted ...	85·0	72·0	69·0	75·5	75·4	4·4	8·6 (P = ·2)
Number of weeks to root	15·3	16·4	17·7	14·3	15·9	0·38	1·22 (P = ·05)

The control plots (C), which have nodal straight cuts just below a node, gave the lowest number of cuttings rooted; cuttings in this treatment also took the longest time to root. The treatment where the cuttings were split through the node (A) gave the highest percentage rooted, while the quickest rooting was caused by the internodal wedge cut (treatment D). Cuttings in the latter treatment rooted appreciably quicker than those subjected to a nodal cut of the same type (treatment B) and a slightly higher percentage rooted was also recorded.

An analysis of the rooting capacity of the four clones represented in this experiment showed the following results :—

TABLE 3

Clone	L. 1	N. 5	N. 100	N. 14	Mean	Standard error	Significant difference (P = ·05)
Percentage rooted ...	56·5	66·0	85·5	93·5	75·4	4·4	14·1
Number of weeks to root	17·9	16·2	16·4	13·2	15·9	0·38	1·22

The superiority of N.14 and N.100 as regards both rooting capacity and speed of rooting under the conditions of this experiment is apparent.

Experiment 3/49.—A second experiment was then laid down to test the effect on the rooting of soft wood cuttings of *C. arabica* of two basal cut positions and four types of cut, and their interactions. The treatments were as follows :—

A. *Position.*

1. Nodal—Cut just below node.
2. Internodal—Cut in centre of internode.

B. *Cut.*

1. Wedge (two-sided).
2. Split.
3. Straight.
4. Slanting (one-sided).

To avoid confusion where the terms "nodal" and "internodal" are used in conjunction with oblique cuts, the following details, showing the precise nature of the cut in respect of each treatment, are given :—

11—Wedge cut through node.	nodal
12—Split through node.	
13—Straight cut just below node.	
14—Slanting cut through node.	
21—Wedge cut starting just below node.	internodal
22—Split up to node.	
23—Straight cut through centre of internode.	
24—Slanting cut starting just below node.	

The experiment was laid out as randomized blocks with confounded interactions. There were three replications, each replicate being represented by one clone and comprising two blocks of four plots each. Each block was contained in one frame and each plot contained fifty cuttings.

The results, after twenty-four weeks, are summarised in Tables 4 and 5 below :—

TABLE 4

Percentage number of cuttings rooted.

POSITION		CUT				
		Wedge 1.	Split 2.	Straight 3.	Slanting 4.	Mean
Nodal ... ... 1.		76·0	82·0	77·4	75·4	77·7
Internodal ... 2.		84·0	89·4	86·6	82·0	85·5
Mean		80·0	85·7	82·0	78·7	81·6

Standard error for cut ... ... = 3·0
Standard error for position ... ... = 2·2
Significant difference for position (P = ·05) ... = 6·8

TABLE 5

Time required to root (in weeks).

POSITION		CUT				
		Wedge 1.	Split 2.	Straight 3.	Slanting 4.	Mean
Nodal ... ... 1.		18·7	18·2	18·9	18·4	18·6
Internodal ... 2.		17·3	16·6	17·5	17·6	17·2
Mean		18·0	17·4	18·2	18·0	17·9

Standard error for cut ... ... = 0·5
Standard error for position ... ... = 0·3
Significant difference for position (P = ·05) ... = 0·9

The internodal position of the basal cut therefore gives both a higher percentage number of cuttings rooted and also induces them to root quicker than the nodal position. In each case, these differences are significant.

The differences between the four types of cut are not significant, but nevertheless the split method has again given the highest percentage rooted and has also rooted them in the shortest time. None of the interactions is significant.

The rooting capacity of the three clones represented in this experiment is shown in the following table :—

TABLE 6

Clone	N. 218	N. 197	L. 1	Mean	Standard error	Significant difference (P = ·05)
Percentage rooted	85·8	83·5	75·5	81·6	2·6	–
Number of weeks to root	16·8	18·0	18·9	17·9	0·4	1·2

Although the differences as regards the percentage number rooted are not significant, L.1 has again shown itself comparatively difficult to root, and the rooting of this clone has taken longer than that of the others in this experiment (cf. Table 3 on page 57).

(b) ROOTING MEDIA

Experiment 4/49.—A comprehensive experiment was laid down in the frames to test the effect on the rooting of softwood cuttings of *C. arabica* of four organic rooting materials and four mixtures with coarse river sand, and their interactions. The treatments were as follows :—

A. *Organic material.*

1. Wild date palm fibre.
2. Coconut fibre.
3. Peat moss.
4. Coffee parchment (husk).

Each material was passed through a sieve with an eighth of an inch mesh.

B. *Mixture, by volume, with coarse river sand.*

	Organic material		Sand
1.	3	:	1
2.	2	:	1
3.	1	:	1
4.	1	:	2

The coarse sand was that which passed through an eighth of an inch sieve but was retained in a one-sixteenth inch sieve.

The experiment was laid out as randomised blocks with confounded interactions. There were three replications, each replicate containing four blocks of four plots each. Each block was contained in one frame, and each plot contained ten cuttings of each of five clones, i.e. fifty cuttings.

The results after twenty-four weeks, calculated on a split-plot basis, are shown in Tables 7 and 8 below :—

TABLE 7

Percentage number of cuttings rooted.

MATERIALS		MIXTURES				
		3 : 1 1	2 : 1 2	1 : 1 3	1 : 2 4	Mean
	Wild date palm fibre... ... 1.	72·0	87·4	93·4	92·0	86·2
	Coconut fibre ... ... 2.	87·4	86·0	72·6	85·4	82·8
	Peat moss ... ... 3.	91·4	84·0	91·4	93·4	90·0
	Coffee parchment ... ... 4.	45·4	58·6	52·6	59·4	54·0
	Mean	74·0	79·0	77·5	82·5	78·3

Standard error for marginal means ... ... = 6·7

Significant difference for materials (P = ·01) = 26·8

TABLE 8

Time required to root (in weeks).

MATERIALS		MIXTURES				
		3 : 1 1.	2 : 1 2.	1 : 1 3.	1 : 2 4.	Mean
	Wild date palm fibre ... 1.	17·2	14·6	14·3	13·0	14·8
	Coconut fibre ... ... 2.	14·6	14·7	15·4	14·5	14·8
	Peat moss ... ... 3.	15·3	16·2	15·9	14·3	15·4
	Coffee parchment ... ... 4.	18·8	19·0	19·8	17·8	18·8
	Mean	16·5	16·1	16·4	14·9	16·0

Standard error for marginal means ... ... = 0·21

Significant difference for marginal means (P = ·001) = 1·1

These results clearly demonstrate the inferiority of coffee parchment as a rooting medium. The percentage number of cuttings rooted in this material is very considerably less than that in the other materials; similarly, cuttings in coffee parchment have taken four weeks longer to root than those in the materials causing the quickest rooting. Both these results are highly significant.

The superiority of peat moss as an ingredient of a rooting medium is again confirmed, though in this instance cuttings took slightly longer to root in it than in the remaining two materials.

The success of the wild date palm fibre is most encouraging. It is bracketed equal with coconut fibre as causing cuttings to root quickest, while in rooting capacity it comes second only to peat moss and is superior to coconut fibre.

There is no significant difference between the percentage numbers of cuttings rooted in the four mixtures, but there is a distinct tendency for rooting to be at a higher rate when the amount of organic material is decreased and the proportion of sand is increased within the limited range of the experiment. This might have been more marked but for some factor (probably a badly fitting frame lid) which upset rooting in one of the frames. The treatments affected by this were :—

Wild date palm fibre	+	sand	@ 3 :1
Coconut fibre	+	,,	@ 1 :1
Peat Moss	+	,,	@ 2 :1
Coffee parchment	+	,,	@ 1 :2

Similarly, rooting is quicker in the 1 :2 mixtures; the mean of the latter, when compared with the mean time taken to root in any of the other mixtures, shows a highly significant difference. The same faulty frame has upset the results again here. Generally speaking, the time required to root follows the same pattern as the percentage number of cuttings rooted.

The rooting capacity, together with the time taken to root, of the five clones used in this experiment is shown in the following table :—

TABLE 9

	N. 14	N. 29	N. 81	R. 15	R. 23	Mean	Standard error	Significant difference
Percentage rooted ...	80·8	87·9	77·1	76·9	68·5	78·2	2·8	7·8 (P = ·05)
Number of weeks to root	16·6	14·8	16·1	15·8	17·0	16·1	0·25	1·19 (P = ·001)

Subsequently, three more separate experiments were laid down using coconut fibre, coffee parchment, and wild date palm fibre respectively. Each was designed to test the effect on rooting of two grades of the organic material and the same four mixtures with coarse river sand as were used in the experiment described above. The treatments were as follows :—

A. *Grade of organic material.*

1. $\frac{1}{4}''$ mesh (except coffee parchment, which was ungraded).
2. $\frac{1}{8}''$ mesh.

B. *Mixture, by volume, with coarse river sand.*

	Organic material		Sand
1.	3	:	1
2.	2	:	1
3.	1	:	1
4.	1	:	2

Each experiment was laid out as randomised blocks with confounded interactions. There were three replications, each replicate being represented by one clone and comprising two blocks of four plots each. Each block was contained in one frame, and each plot contained fifty cuttings, except in the experiment using wild date palm fibre, where there were only forty cuttings per plot.

Their results after twenty-four weeks are shown in Tables 10 to 16 following.

Coconut Fibre

Experiment 5/49

Table 10

Percentage number of cuttings rooted.

		MIXTURES				
		3 : 1 1.	2 : 1 2.	1 : 1 3.	1 : 2 4.	Mean
GRADES	¼″ 1.	67·4	84·6	89·4	75·4	79·2
	⅛″ 2.	83·4	82·6	73·4	88·6	82·0
	Mean	75·3	83·7	81·3	82·0	80·6

Standard error for grades ... ... = 3·2
Standard error for mixtures ... ... = 4·6

Table 11

Time required to root (in weeks).

		MIXTURES				
		3 : 1 1.	2 : 1 2.	1 : 1 3.	1 : 2 4.	Mean
GRADES	¼″ 1.	18·0	17·4	16·0	16·4	17·0
	⅛″ 2.	16·2	17·7	18·9	16·4	17·3
	Mean	17·1	17·5	17·5	16·4	17·1

Standard error for grades ... ... = 0·36
Standard error for mixtures ... ... = 0·50

None of the differences is significant. It is unfortunate that once again some uncongenial factor in one of the frames (again probably an ill-fitting lid) upset the general tendency, which favoured the mixtures with less organic material. There appears to be little difference between the two grades, but where the coarser grade is used, care must be taken to ensure that there are no small hard lumps.

Coffee Parchment

Experiment 6/49

Table 12

Percentage number of cuttings rooted.

		MIXTURES				
		3 : 1 1.	2 : 1 2.	1 : 1 3.	1 : 2 4.	Mean
GRADES	Ungraded ... 1.	38·6	34·6	58·6	76·0	52·0
	⅛" ... ... 2.	31·4	46·6	64·0	68·0	52·5
	Mean	35·0	40·6	61·3	72·0	52·2

Standard error for grades ... ... = 3·7
Standard error for mixtures ... ... = 5·2
Significant difference for mixtures (P = ·01) = 22·8

Table 13

Time required to root (in weeks)

		MIXTURES				
		3 : 1 1.	2 : 1 2.	1 : 1 3.	1 : 2 4.	Mean
GRADES	Ungraded ... 1.	18·9	19·5	18·2	17·7	18·6
	⅛" ... ... 2.	19·6	18·1	17·5	16·6	17·9
	Mean	19·3	18.8	17·9	17·2	18·3

Standard error for grades ... ... = 0·24
Standard error for mixtures ... ... = 0·34
Significant difference for mixtures (P = ·05) = 1·06

These results show that in the case of coffee parchment a higher percentage number of cuttings is rooted in a shorter time, as the proportion of organic material is decreased and that of sand is increased. These differences are significant. The comparatively small number rooted in this material confirms the relative poorness of coffee parchment as a rooting medium (cf. Table 7 on page 60). There is no significant differences between the two grades.

Wild Date Palm Fibre

Experiment 7/49

Table 14

Percentage number of cuttings rooted.

		MIXTURES				
		3 : 1 1.	2 : 1 2.	1 : 1 3.	1 : 2 4.	Mean
GRADES	$\frac{1}{4}$" 1.	90·0	95·0	90·0	97·5	93·1
	$\frac{1}{8}$" 2.	92·5	90·8	94·2	91·7	92·3
	Mean	91·3	92·9	92·1	94·6	92·7

Standard error for grades ... ... = 1·2
Standard error for mixtures ... ... = 1·7

Table 15

Time required to root (in weeks).

		MIXTURES				
		3 : 1 1.	2 : 1 2.	1 : 1 3.	1 : 2 4.	Mean
GRADES	$\frac{1}{4}$" 1.	15·2	14·4	13·6	13·4	14·1
	$\frac{1}{8}$" 2.	13·9	15·7	14·5	15·1	14·8
	Mean	14·6	15·0	14·1	14·2	14·5

Standard error for grades ... ... = 0·3
Standard error for mixtures ... ... = 0·4

None of the differences is significant. Rooting is of a high standard and is generally fairly uniform throughout all treatments; nevertheless the same tendency towards increased rooting, as the proportion of the organic material is decreased and that of the sand is increased, is again apparent here. The time required to root does not, however, follow the pattern of the mixtures to quite the same extent as with the other materials.

An analysis of the rooting capacity of the clones used in these three experiments is shown in Table 16.

TABLE 16

	Clone	% rooted	Weeks to root	Clone	% rooted	Weeks to root	Clone	% rooted	Weeks to root
Clones ...	N. 100	87·3	16·8	AB. 11	70·0	17·9	N. 219	93·1	14·8
	N. 71	86·3	16·8	N. 20	39·3	18·6	H. 61	89·1	14·8
	R. 3	68·3	17·9	N. 50	47·5	18·3	N. 39	95·9	13·8
Mean		80·6	17·1		52·3	18·3		92·7	14·5
Standard error		3·9	0·44		4·5	0·29		1·5	0·35
Significant difference ... (P = ·01)		–	–		19·8	–		–	–

ACKNOWLEDGMENT

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Lyamungu,
December, 1950.

L. M. FERNIE,
Horticulturist

C.R.S. COFFEE

Grades and Classes

1945/46				1946/47				1947/48			
Grades	Percentages	Classes	Percentages	Grades	Percentages	Classes	Percentages	Grades	Percentages	Classes	Percentages
AA	19·28	1		AA	3·73	1		AA	7·59	1	
A	45·61 } 71·56	2	15·60	A	23·61 } 33·96	2		A	56·15 } 69·71	2	
PB	6·67	3	—	PB	6·62	3	20·46	PB	5·97	3	15·27
B	5·74	4	51·16 } 71·79	B	18·01	4	11·23 } 45·19	B	13·82	4	24·88 } 70·32
E	3·45	5	5·03	E	0·13	5	13·50	E	1·20	5	30·17
C	1·54	6	10·04	C	7·59	6	11·52	C	4·61	6	15·47
T	4·09	7	1·76	T	13·30	7	7·21	T	4·27	7	4·44
T.T.	4·91	8	8·01	T.T.	7·42	8	23·73	T.T.	5·30	8	5·76
H.P.	1·99	9	6·81	H.P.	2·84	9	6·98	H.P.	1·10	9	1·39
U.G.	6·71	10	1·48	U.G.	16·75	10	5·38	U.G.		10	1·86
		11	0·11			11				11	0·77
		12				12				12	
		13				13				13	
Total Tonnage (Clean Coffee)	26			3·52				41·93			

1948/49				1949/50			
Grades	Percentages	Classes	Percentages	Grades	Percentages	Classes	Percentages
AA	34·45	1	11·66	AA	14·36	1	7·41
A	40·08 } 83·50	2	58·26	A	34·68 } 52·48	2	—
PB	8·97	3	— } 88·88	PB	3·44	3	32·49 } 79·80
B	8·09	4	14·62	B	31·50	4	13·88
E	0·83	5	4·34	E	0·98	5	26·02
C	1·10	6	5·84	C	6·37	6	7·64
T	1·60	7	3·02	T	4·74	7	8·23
T.T.	4·70	8	1·28	T.T.	3·70	8	0·80
H.P.	0·18	9	0·30	H.P.	0·23	9	3·06
U.G.		10	0·21	U.G.		10	0·43
		11	0·49			11	0·04
		12				12	
		13				13	
Total Tonnage (Clean Coffee)	20·83			47·33			

MONTHLY RAINFALL FROM SEPTEMBER, 1937 TO END OF AUGUST, 1949

(in inches)

	September 1937 to end of August 1938	September 1938 to end of August 1939	September 1939 to end of August 1940	September 1940 to end of August 1941	September 1941 to end of August 1942	September 1942 to end of August 1943	September 1943 to end of August 1944	September 1944 to end of August 1945	September 1945 to end of August 1946	September 1946 to end of August 1947	September 1947 to end of August 1948	September 1948 to end of August 1949
September ...	1·03	0·17	1·61	0·33	2·76	0·11	0·49	2·42	0·20	7·34	1·23	0·30
October ...	4·35	2·16	0·08	1·03	0·09	0·42	0·17	3·15	0·05	4·71	1·27	2·51
November ...	3·91	2·57	0·57	0·90	4·47	3·60	2·00	3·10	4·66	1·13	0·93	1·65
December ...	1·64	1·02	0·32	1·07	9·72	1·75	0·32	5·14	0·30	2·19	1·31	6·19
January ...	0·52	0·22	2·83	1·23	1·59	0·07	1·02	1·72	0·02	2·01	0·46	1·79
February ...	2·43	0·41	5·27	1·91	0·38	2·61	1·69	1·39	1·14	0·72	0·71	4·17
March	12·42	4·57	4·12	2·38	15·02	1·32	5·82	4·85	0·57	3·37	2·72	0·10
April	10·79	26·18	21·63	15·92	37·07	7·95	30·04	15·19	16·90	28·45	14·50	9·34
May	19·44	25·31	12·04	10·24	19·43	19·46	11·97	21·34	22·74	25·73	15·56	10·64
June	2·61	8·74	2·68	5·09	4·54	4·06	4·65	3·45	2·54	10·97	2·93	0·92
July	1·92	0·77	2·04	0·76	2·38	4·42	2·21	3·15	0·59	1·43	1·53	1·86
August ...	0·67	0·54	2·58	2·10	1·22	0·37	1·43	1·33	1·03	1·38	0·44	0·82
Tot (in inches)	61·73	72·66	55·77	42·96	98·67	46·14	61·81	66·23	50·74	89·43	43·59	40·29

Rainfall for remaining months of 1949 (in inches): September 0·33; October 0·69; November 0·26; December 1·38.